Grant PUD Surface Water Application

**Attachment A**

Boyce Site Legal Description

EXHIBIT "A"

LEGAL DESCRIPTION OF THE PROPERTY

That portion of the Southeast quarter of the Northeast quarter of Section 11, Township 26 North, Range 16, E.W.M., Chelan County, Washington, lying North of the railroad right-of-way, East of the Nason Creek right-of-way, and South of State Highway 2.

Except there from those portions conveyed to the State of Washington by deeds recorded under Auditor's File Numbers 236889 and 462806.

Tax Parcel No. 261611140020

Grant PUD Surface Water Application

**Attachment B**

Youngsman Site Legal Description

File Youngsman



0144791

REAL ESTATE EXCISE TAX
EXEMPT
Chelan County Treasurer
David E. Griffiths, CPA
By JSay 1-9-09
Date

**AFTER RECORDING MAIL TO:**

| | |
|---|---|
| Name | Public Utility District No. 2 of Grant County |
| Address | c/o Sheryl Dotson, Lands Specialist, PO Box 878 |
| City/State | Ephrata WA 98823 |

1166583

**Document Title(s):**

1. Statutory Warranty Deed ** RE-RECORD TO CORRECT LEGAL DESCRIPTION**

**Reference Number(s) of Documents Assigned or released:**

**Grantor(s):**

1. James E. Youngsman and Ruth M. Youngsman
2.

[ ] Additional information on page of document

**Grantee(s):**

1. Public Utility District No. 2 of Grant County
2.

[ ] Additional information on page of document

**Abbreviated Legal Description:**

NE¼, SW¼ OF SECTION 12, TOWNSHIP 26 NORTH, RANGE 16 EAST, CHELAN COUNTY

**Tax Parcel Number(s):**

261612230100

[ X ] Complete legal description is on page 1 of document

I am requesting an emergency nonstandard recording for an additional fee as provided in RCW 36.18.010. I understand that the recording processing requirements may cover up or otherwise obscure some part of the text of the original document.

**EXHIBIT A**

LEGAL DESCRIPTION:

PARCEL A:
ALL THAT PORTION OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER AND THE NORTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 12, TOWNSHIP 26 NORTH RANGE 16, E.W.M., CHELAN COUNTY, WASHINGTON, LYING SOUTHERLY OF THE SOUTHERLY RIGHT OF WAY LINE FOR PRIMARY STATE HIGHWAY (P.S.H.) 15 (NOW STATE ROUTE 2) AND LYING NORTHERLY OF THE NORTHERLY RIGHT OF WAY LINE FOR THE BURLINGTON NORTHERN SANTA FE RAILROAD;

TOGETHER WITH THAT PORTION OF RIGHT OF WAY FOR OLD P.S.H. 15 VACATED BY FINAL ORDER OF THE CHELAN COUNTY COMMISSIONERS DATED AUGUST 30, 1976, RECORDED IN BOOK 736 OF DEEDS, AT PAGE 1263, UNDER AUDITOR'S FILE NO. 764072, WHICH WOULD ATTACH BY OPERATION OF LAW.

PARCEL B:

ALL THAT PORTION OF THE NORTH HALF OF THE NORTHEAST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 12, TOWNSHIP 26 NORTH, RANGE 16, E.W.M., LYING BETWEEN THE SOUTHERLY RIGHT OF WAY LINE OF PRIMARY STATE HIGHWAY NO. 15 (NOW STATE ROUTE NO. 2) AND THE NORTHERLY RIGHT OF WAY LINE OF BURLINGTON NORTHERN RAILROAD.

JEG
INITIAL

Grant PUD Surface Water Application

**Attachment C**

Preliminary Site Drawings

| ACAD FILE NO: | DESIGNED BY: | DRAWN BY: | CHECKED BY: | APPROVED BY: | LAST UPDATED: | ACAD FILE PATH: | LAST PLOTTED: |
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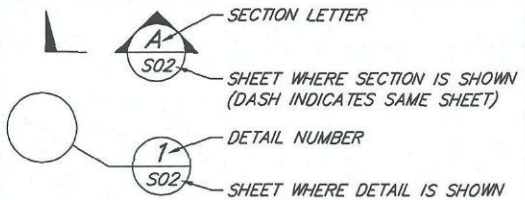
| NC-PH-F01 | DLA | LN | | | SHERRYAE 05/10/2010 10:03 AM | H:\NASONCREEK\WATERRIGHTPERMIT\FIGURESUPDATE | 5/10/2010 11:32 AM |

Grant County
**PUBLIC UTILITY DISTRICT**
*Excellence in Service and Leadership*

# NASON CREEK HATCHERY INTAKE AND OUTFALL

## DETAILING CONVENTIONS



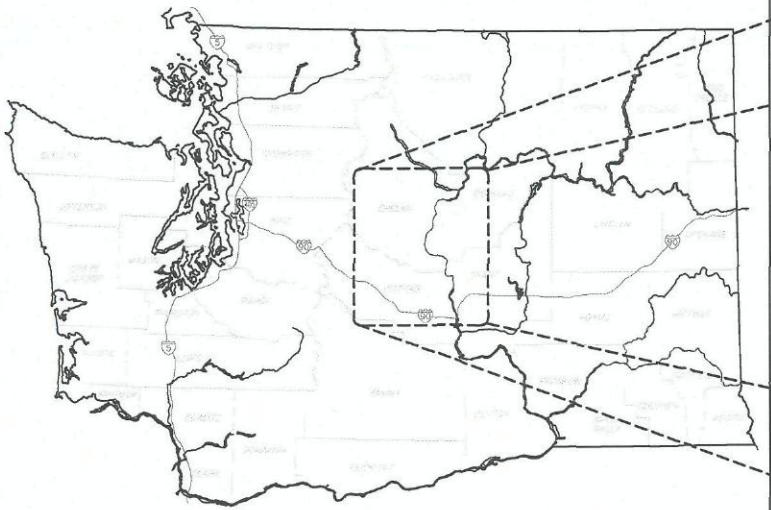

## DRAWING IDENTIFICATION

THE DRAWINGS IN THIS SET ARE IDENTIFIED WITH THE FOLLOWING DESIGNATION SYSTEM:

NC-PH-F01-A

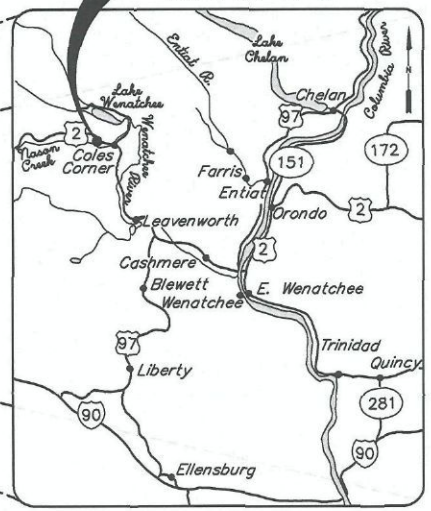
- A — REVISION NUMBER OR LETTER
- F01 — DISCIPLINE/DRAWING NUMBER
- PH — SUBPROJECT IDENTIFICATION CODE
- NC — PROJECT LOCATION

## LOCATION MAP



STATE OF WASHINGTON

PROJECT SITE
LAT: 47° 46' 3"
LONG: 120° 48' 5"




## DRAWING INDEX

| DWG NO. | REV. | DRAWING TITLE | DRAWING SUBTITLE 1 | DWG. SUBTITLE 2 |
|---|---|---|---|---|
| NC-PH-F01 | A | NASON CREEK HATCHERY INTAKE AND OUTFALL | LOCATION MAP, DETAILING CONVENTIONS, | DRAWING IDENTIFICATION, & INDEX |
| NC-PH-F02 | A | NASON CREEK HATCHERY INTAKE AND OUTFALL | GENERAL SITE PLAN | |
| NC-PH-F03 | A | NASON CREEK HATCHERY INTAKE AND OUTFALL | PUMP STATION AND OUTFALL | PLAN |
| NC-PH-F04 | A | NASON CREEK HATCHERY INTAKE AND OUTFALL | PUMP STATION AND OUTFALL | SECTIONS |
| NC-PH-F05 | A | NASON CREEK HATCHERY INTAKE AND OUTFALL | PUMP STATION | PLAN AND SECTION |

## DIRECTIONS TO SITE

1. FROM THE TOWN OF LEAVENWORTH TRAVEL WEST ON U.S. HWY. 2,
2. CONTINUE ON U.S. HWY 2 FOR APPROXIMATELY 17 MILES THEN TURN LEFT INTO THE PROJECT SITE.

PRELIMINARY
NOT FOR CONSTRUCTION
05-10-2010

| REV | DATE | NATURE OF REVISION | BY | APPD | APPD |
|---|---|---|---|---|---|
| PROJECT I.D. NO. | CONTRACT NO. | DRAWING STATUS: INTERIM | MANUFACTURER'S JOB NO.: W3X43600 | MANUFACTURER'S CODE NO.: JACI | |

JACOBS

PERMIT APPLICANT: Grant County PUBLIC UTILITY DISTRICT, 30 C Street S.W., P.O. Box 878, Ephrata, WA 98823

PERMIT REFERENCE NO.

WATERBODY: NASON CREEK (R.M. 9.3)

PLAIN — CHELAN

NASON CREEK — HATCHERY

TITLE: NASON CREEK HATCHERY INTAKE AND OUTFALL LOCATION MAP, DETAILING CONVENTIONS, DRAWING IDENTIFICATION, AND INDEX

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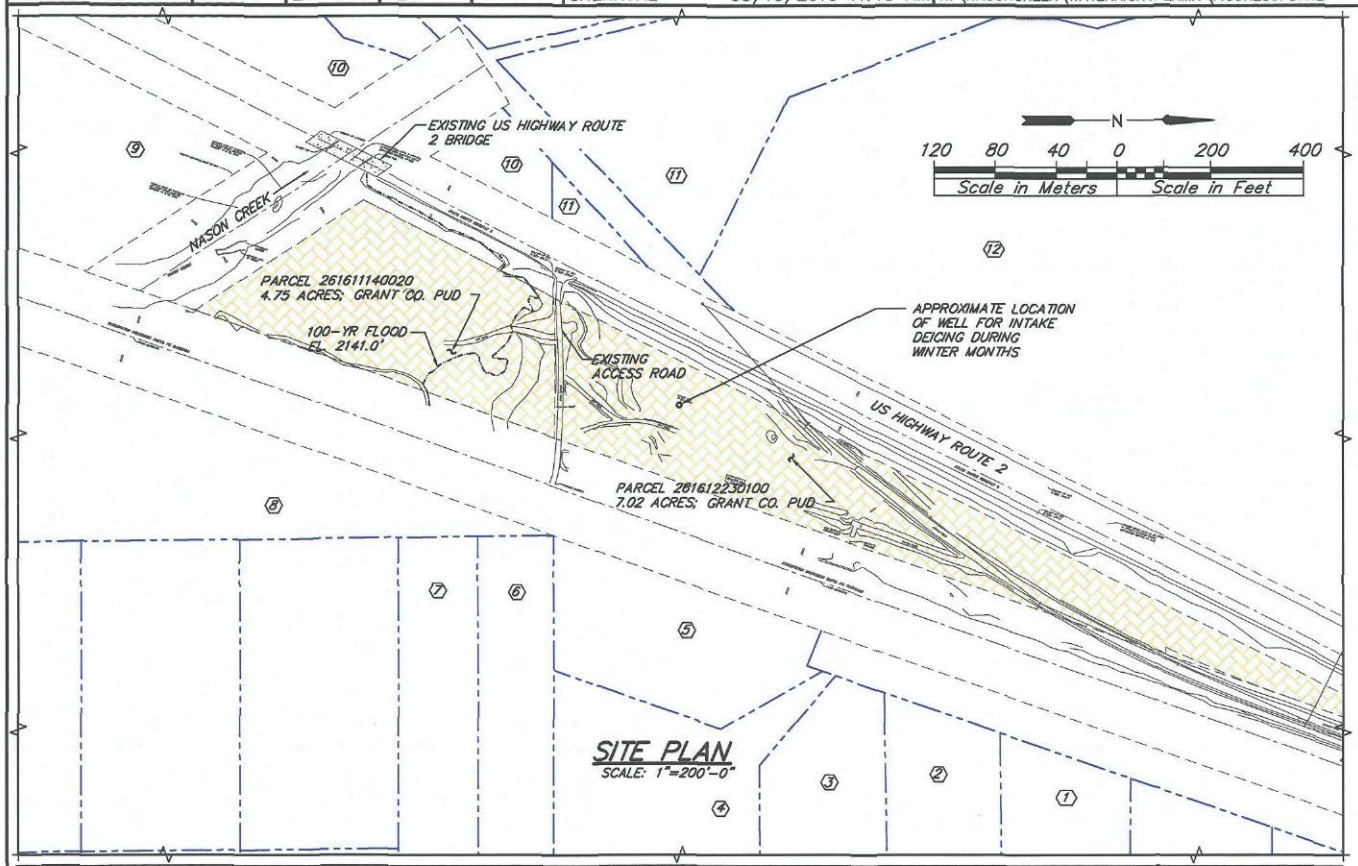


## NOTES:

1. FISH ARE TRANSFERRED TO ACCLIMATION REARING UNITS IN THE FALL. FISH REAR IN THESE ACCLIMATION REARING UNITS UNTIL RELEASED DURING THE FOLLOWING SPRING.
2. GRANT PUD PROPERTY BOUNDARY IS FROM THE ERLANDSEN SURVEY OF 2008. ADJACENT PROPERTY OWNERSHIP INFORMATION ESTIMATED FROM ERLANDSEN.COM, MAP BROWSER AND CHELAN COUNTY ASSESOR'S WEB SITE.
3. ACCLIMATION REARING UNITS TO PROVIDE AT LEAST 51,000 CF OF VOLUME WITH UP TO 4,275 GPM OF FLOW. DETERMINATION AND DESIGN OF EXACT UNIT STYLE, NUMBER, AND LOCATION IN PROCESS.

## ADJACENT PROPERTY OWNERS

| I. D. | OWNER | ADDRESS | PARCEL NO. | ACRES |
|---|---|---|---|---|
| (1) | STEVE & DEBRA LAMBERTO TRUST | 6217 OLD NANOVER RD, SPRING GROVE, PA 17362 | 261612601030 | 2.50 |
| (2) | JAMES & KRISTIE KELLEY | 1020 123RD AVE NE, LAKE STEVENS, WA 98258 | 261612601040 | 2.50 |
| (3) | RICHARD & JULIE EDWARDS | 23124 165TH AVE SE, MONROE, WA 98272 | 261612601050 | 2.50 |
| (4) | ARMOND DU BUQUE | P.O. BOX 2124, LEAVENWORTH, WA 98826 | 261612601070 | 3.25 |
| (5) | JOSHUA & JAMIE TAYLOR | 22705 ECHO LAKE RD, SNOHOMISH, WA 98296 | 261612601060 | 3.25 |
| (6) | TROY & BRENDA CARLSON | 1439 OLYMPIC VIEW DR, EDMONDS, WA 98020 | 261611410050 | 5.00 |
| (7) | RALPH S BYTHER | P.O. BPX 923, GRAHAM, WA 98826 | 261611410100 | 5.00 |
| (8) | YAKIMA NATION LAND ENTERPRISE | P.O. BOX 151 TOPPENISH, WA98948-1302 | 261611100050 | 27.18 |
| (9) | JEFFRY L GAY | 4830 175TH AVENUE SE, SNOHOMISH, WA 98290 | 2616111100100 | 7.11 |
| (10) | LESLIE AND ALMA BOYCE TRUST | 7303 W 11TH AVE, KENNEWICK, WA 99338-1302 | 261611120000 | 3.47 |
| (11) | SANDRA I WARD | 5501 MERO RD, SNOHOMISH, WA 98290 | 261612230075 | 6.43 |
| (12) | WASHINGTON STATE | P.O. BOX 47014, OLYMPIA, WA 98504-7014 | 261612200100 | 46.28 |

PRELIMINARY
NOT FOR CONSTRUCTION
05-10-2010

| REV | DATE | NATURE OF REVISION | BY | APPD | APPD |
|---|---|---|---|---|---|
| PROJECT I.D. NO. | CONTRACT NO. | DRAWING STATUS: INTERIM | MANUFACTURER'S JOB NO.: W3X43600 | MANUFACTURER'S CODE NO.: JACI | |

JACOBS

PERMIT APPLICANT: Grant County PUBLIC UTILITY DISTRICT, 30 C Street S.W., P.O. Box 878, Ephrata, WA 98823

PERMIT REFERENCE NO.

WATERBODY: NASON CREEK (R.M. 9.3)

IN: PLAIN — CHELAN

NASON CREEK | HATCHERY

TITLE: NASON CREEK HATCHERY INTAKE AND OUTFALL GENERAL SITE PLAN

| DRAWN BY | DATE DRAWN | SCALE | DWR/PRT | FIGURE NUMBER | SHEET NO | DGE FILE NAME |
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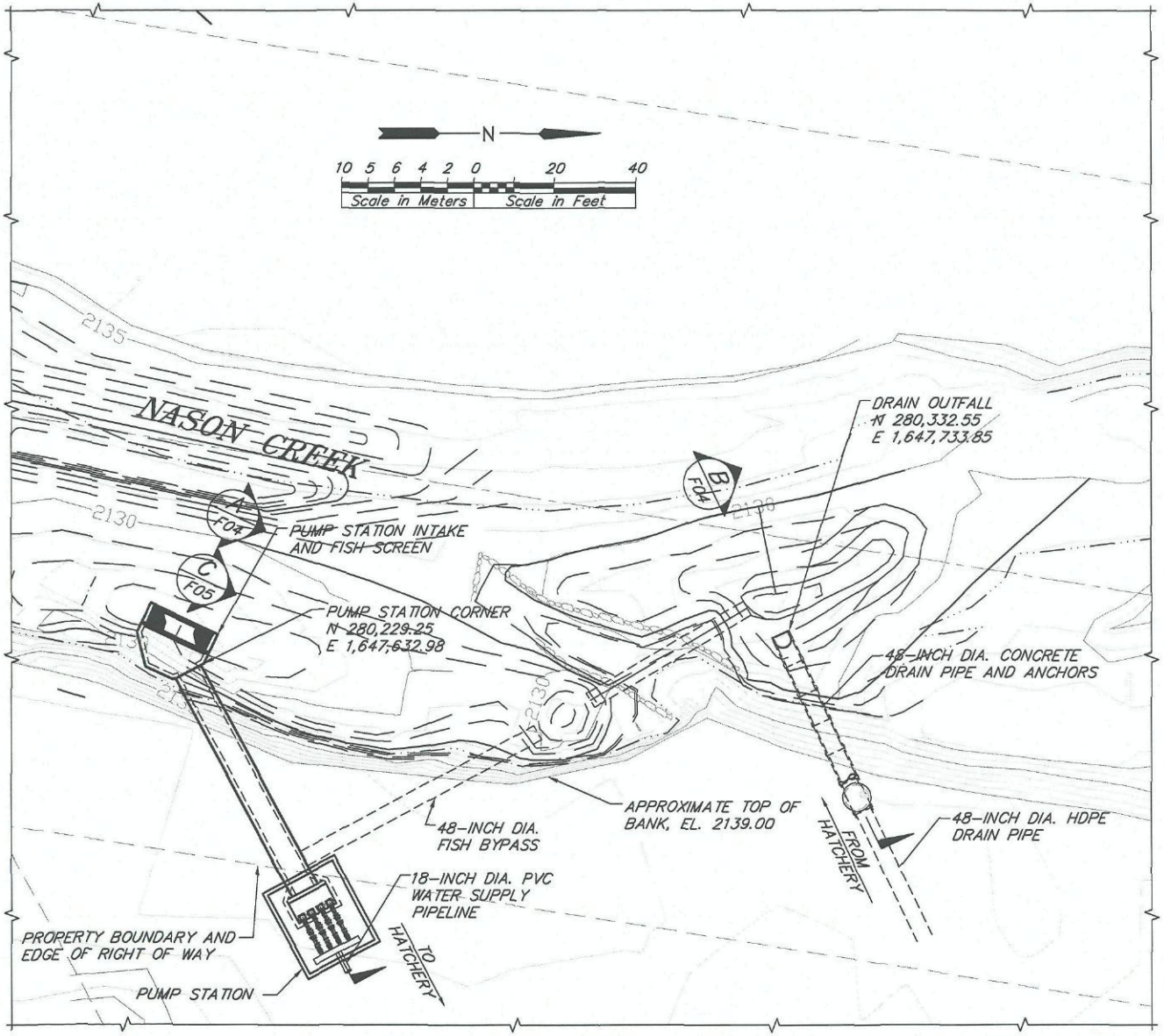


## PUMP STATION AND OUTFALL PLAN

SCALE: 1"=20'-0"

## NOTES:

1. TOPOGRAPHIC INFORMATION FOR NASON CREEK AND SITE BASED ON 1.0' CONTOUR SITE SURVEY (ERLANDSEN, 2008)
2. O.H.W. LINE SHOWN ON 2008 SITE SURVEY (ERLANDSEN, 2008) AT APPROXIMATELY ELEVATION 2131.33' ABOVE SEA LEVEL, NATIONAL GEODETIC VERTICAL DATUM 1929 (NGVD 29).
3. FLOOD INSURANCE RATE MAP, CHELAN COUNTY WASHINGTON. PANEL 775 OF 1075. FEDERAL EMERGENCY MANAGEMENT AGENCY. 1989, JUNE 5. INDICATES THE 100-YEAR BASE FLOOD ELEVATION AS 2141.0' ABOVE SEA LEVEL, NGVD 29.

**PRELIMINARY**
NOT FOR CONSTRUCTION
05-10-2010

| REV | DATE | NATURE OF REVISION | BY | APPD | APPD |
|---|---|---|---|---|---|
| | | | | | |

| PROJECT I.D. NO. | CONTRACT NO. | DRAWING STATUS | MANUFACTURER'S JOB NO. | MANUFACTURER'S CODE NO. |
|---|---|---|---|---|
| | | INTERIM | W3X43600 | JACI |

JACOBS

PERMIT APPLICANT
Grant County PUBLIC UTILITY DISTRICT
30 C Street S.W., P.O. Box 878, Ephrata, WA 98823

PERMIT REFERENCE NO.

WATERBODY: NASON CREEK (R.M. 9.3)
IN: PLAIN — CHELAN

NASON CREEK | HATCHERY

TITLE
NASON CREEK HATCHER INTAKE AND OUTFALL PUMP STATION AND OUTFALL PLAN

| DRAWN BY | DATE DRAWN | SCALE | DWR/PRT | FIGURE NUMBER | SHEET NO | DOS FILE NAME |
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| | PVB | C | | | | |

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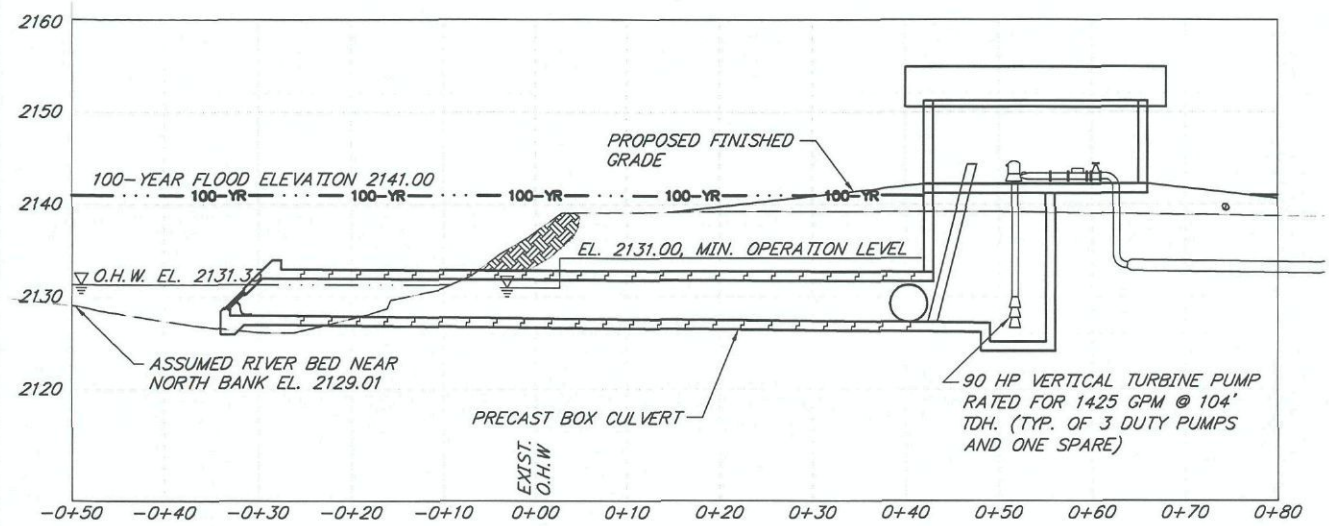
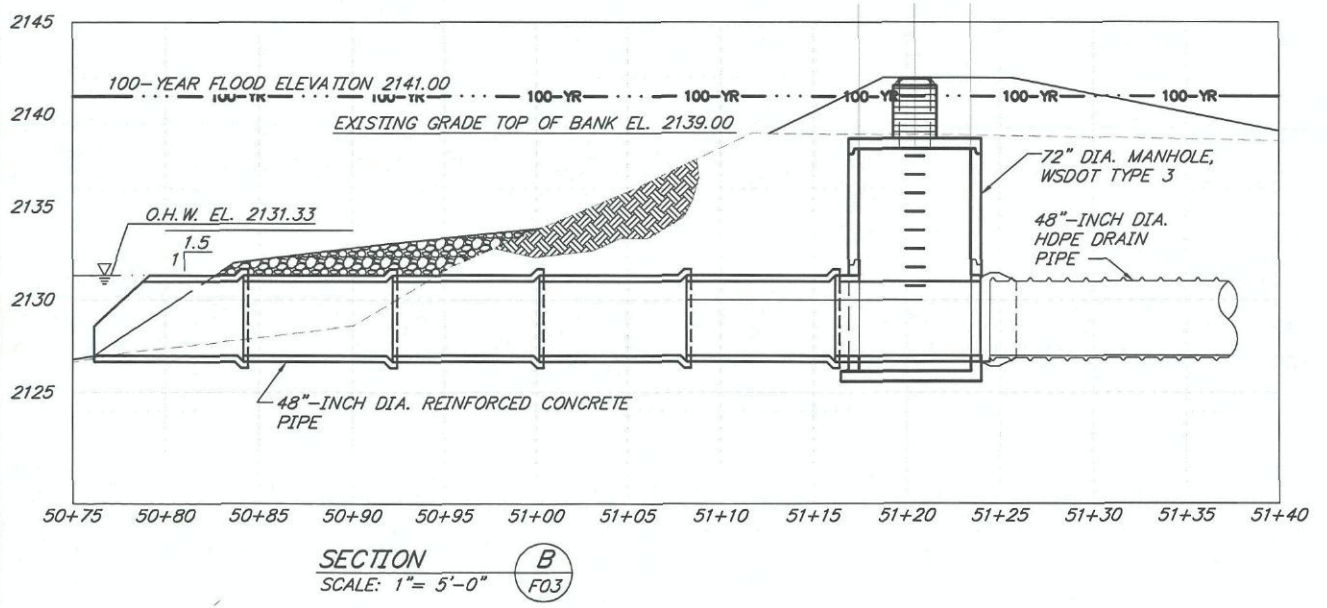



SECTION A
SCALE: 1"= 10'-0" F03




SECTION B
SCALE: 1"= 5'-0" F03

## NOTES:

1. TOPOGRAPHIC INFORMATION FOR THE SITE BASED ON 1.0-FOOT CONTOUR SURVEY (ELANDSEN, 2008).
2. ORDINARY HIGH WATER (O.H.W.) LINE SHOWN ON 2008 SITE SURVEY (ELANDSEN) AT APPROXIMATELY ELEVATION 2131.33' ABOVE SEA LEVEL, NATIONAL GEODETIC VERTICAL DATUM 1929 (NGVD 29).
3. FLOOD INSURANCE RATE MAP, CHELAN COUNTY WASHINGTON. PANEL 775 OF 1075. FEDERAL EMERGENCY MANAGMENT AGENCY. 1989, JUNE 5. INDICATES THE 100-YEAR BASE FLOOD ELEVATION AS 2141.0' ABOVE SEA LEVEL, NGVD 29.

PRELIMINARY
NOT FOR CONSTRUCTION
05-10-2010

| REV | DATE | NATURE OF REVISION | BY | APPD | APPD |
|---|---|---|---|---|---|
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| PROJECT I.D. NO. | CONTRACT NO. | DRAWING STATUS | MANUFACTURER'S JOB NO. | MANUFACTURER'S CODE NO. |
|---|---|---|---|---|
| | | INTERIM | W3X43600 | JACI |

JACOBS

PERMIT APPLICANT
Grant County PUBLIC UTILITY DISTRICT
30 C Street S.W., P.O. Box 878, Ephrata, WA 98823

PERMIT REFERENCE NO.
WATERBODY: NASON CREEK (R.M. 9.3)
IN: PLAIN CHELAN

NASON CREEK HATCHERY

TITLE
NASON CREEK HATCHERY INTAKE AND OUTFALL PUMP STATION AND OUTFALL SECTIONS

| DRAWN BY | DATE DRAWN | SCALE | DWG/PRT | FIGURE NUMBER | SHEET NO | DGS FILE NAME |
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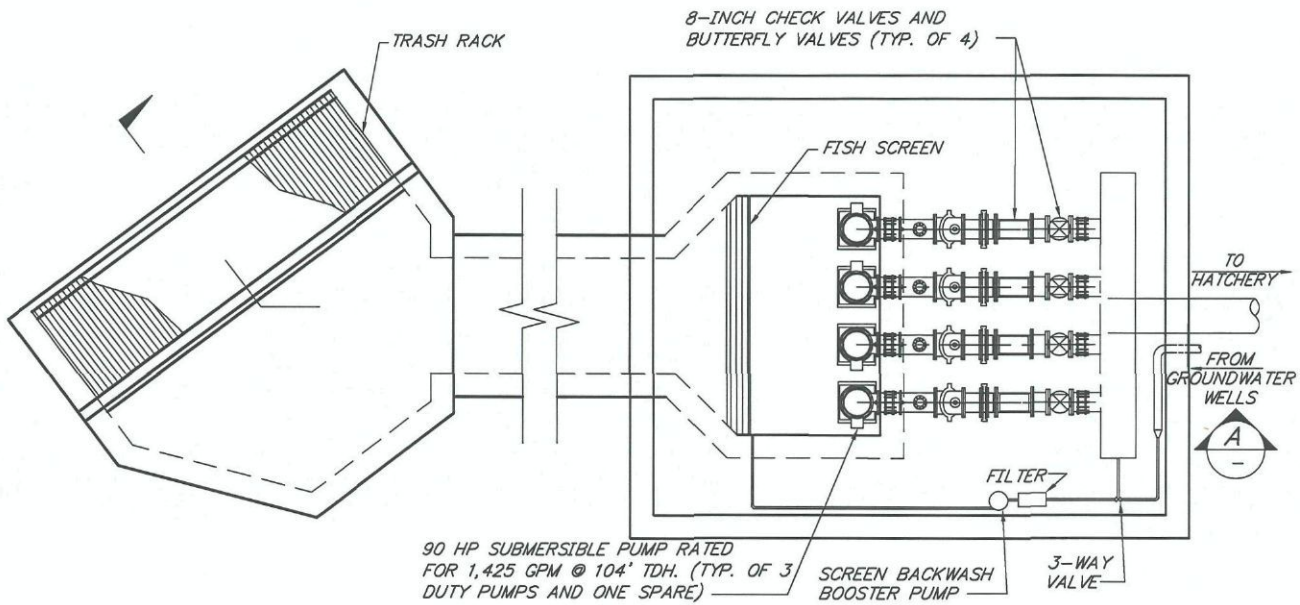
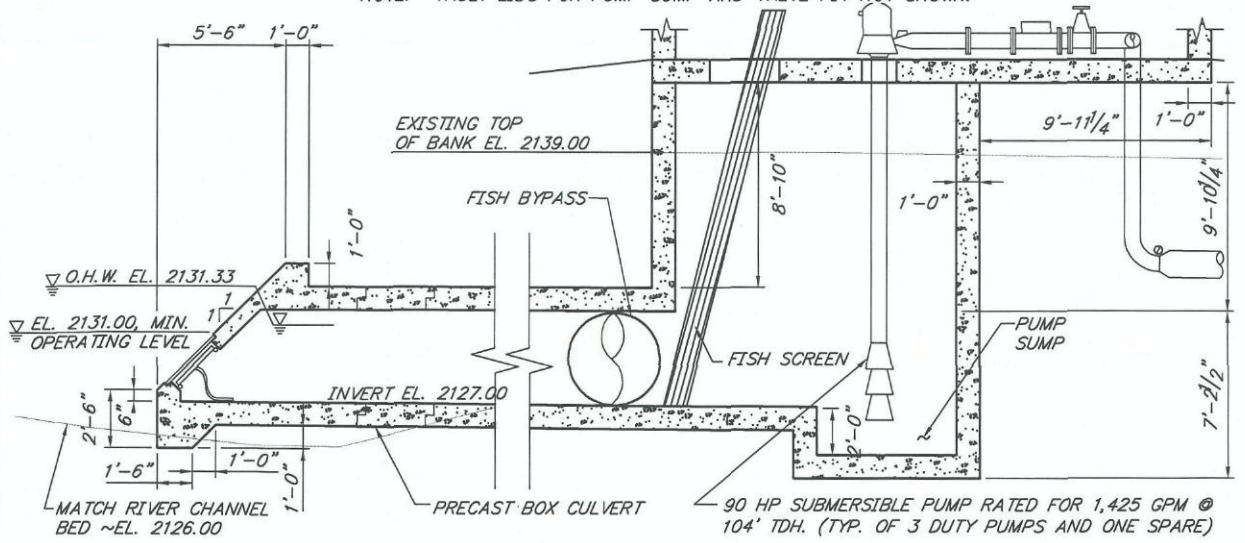



## PUMP STATION PLAN

SCALE: 1/4"=1'-0"

NOTE: VAULT LIDS FOR PUMP SUMP AND VALVE PIT NOT SHOWN.




SECTION A/- C/F03

SCALE: 1/4"= 1'-0"

## NOTES:

1. GROUNDWATER WILL BE INJECTED IN AN EVEN SHEET ACROSS FISH SCREEN TO PREVENT ICING DURING FRAZIL ICE CONDITIONS.
2. THE FISH SCREEN WILL BE CLEANED BY HIGH PRESSURE SPRAY BARS. THE SCREEN CLEANING OPERATION WILL BE TRIGGERED AUTOMATICALLY AT A DIFFERENTIAL ACROSS THE SCREEN GREATER THAN 0.1 FEET OF WATER. SCREEN CLEANING DRIVE WATER SUPPLIED BY SUBMERSIBLE BOOSTER PUMP. CLEANING WATER WILL BE DRAWN FROM EITHER THE SURFACE WATER SUPPLY HEADER (NORMAL OPERATIONS) OR THE GROUNWATER WELL SUPPLY PIPELINE (WINTER FRAZIL ICE CONDITIONS).

PRELIMINARY
NOT FOR CONSTRUCTION
05-10-2010

| REV | DATE | NATURE OF REVISION | BY | APPD | APPD |
|---|---|---|---|---|---|

| PROJECT I.D. NO. | CONTRACT NO. | DRAWING STATUS | MANUFACTURER'S JOB NO. | MANUFACTURER'S CODE NO. |
|---|---|---|---|---|
| | | INTERIM | W3X43600 | JACI |

JACOBS

PERMIT APPLICANT
Grant County PUBLIC UTILITY DISTRICT
30 C Street S.W., P.O. Box 878, Ephrata, WA 98823

PERMIT REFERENCE NO.
WATERBODY: NASON CREEK (R.M. 9.3)
IN: PLAIN CHELAN
NASON CREEK | NATURALIZED HATCHERY

TITLE
NASON CREEK HATCHERY INTAKE AND OUTFALL PUMP STATION PLAN AND SECTION

| DRAWN BY | DATE DRAWN | SCALE | DWR/PKT | FIGURE NUMBER | SHEET NO | DGS FILE NAME |
|---|---|---|---|---|---|---|
| AES | MAY 2010 | AS SHOWN | | NC-PH-F05-A | 5 OF 5 | |
| CHECKED | ORIGINATOR | DRAWING SIZE | DWR/PKT | | | PLOT DATE: 04/27/10 |
| | PVB | C | | | | |

# NASON CREEK
# DRAFT GROUNDWATER REPORT

**Prepared for**

Grant County Public Utility District
P.O. Box 878
Ephrata, WA 98823

**Prepared by**

Anchor QEA, LLC
811 Kirkland Ave., Suite 200
Kirkland, WA 98033

**May 2009**

# TABLE OF CONTENTS



## List of Figures

## Appendices

## INTRODUCTION AND PURPOSE OF GROUNDWATER STUDY

Grant County Public Utility District (Grant PUD) is planning the construction of hatchery-related facilities in the Nason Creek basin located within the Wenatchee River Watershed and Chelan County, WA. Three parcels were purchased by Grant PUD (Cascade Gardens, Boyce and Youngsman) that are in close proximity to each other and located about 18 miles west of Leavenworth. A site location map is shown in Figure 1.

The facilities planned by Grant PUD will require surface water and groundwater. The purpose of this project is to investigate what groundwater resources are available in Nason Creek near the parcels, provide recommendations for long-term safe yields for groundwater and to estimate potential effects to nearby wells and to Nason Creek. The Boyce and Youngsman parcels will likely contain the facilities based upon their size, location and availability of water and the analyses are focused on those properties.

The volumes of groundwater desired range up to 2,400 gallons per minute (gpm) with the peak demands occurring in late summer and early fall.

## EXISTING GEOLOGIC AND HYDROLOGIC INFORMATION

Existing information and data is available to help characterize groundwater resources in the project area. Well logs are available from Washington Department of Ecology, geologic maps are available from the Washington Department of Natural Resources, GIS data is available from Chelan County and LIDAR topographic data was prepared for Grant PUD. Streamflow and stage data in Nason Creek are available from the Washington Department of Ecology and from Grant PUD.

The geology of the project area is shown in Figure 2. The Nason Creek valley is comprised of alluvial and glaciofluvial sediments deposited over bedrock consisting of sandstone and schist. Groundwater is present in the sediments and is recharged from streamflow and precipitation. Very little groundwater is available in the underlying bedrock formations. There are a number of available well logs (locations of which are also shown on Figure 2) that help characterize the type and thickness of sediment layers and occurrence of groundwater. A review of well logs near the site show layers of sand and gravel interbedded

with silty sand fining down to clay layers. Large producing wells need to be developed into a thick layer of sands and gravels that is of a large areal extent. The intent of the groundwater exploration program described in the following section was to determine whether those conditions exist at the sites owned by Grant PUD, whether the 2,400 gpm demand can be met at the sites and if not, what is the yield that can be obtained. Appendix A contains the well logs shown on Figure 2, organized by Section, Township and Range. On Figure 2, well logs shown with a "U" prefix were not located by parcel, whereas the other well logs were located by parcel through information on the well log and verification of the name or address with the Chelan County Assessors GIS database.

A stream gage was installed by Ecology near the mouth of Nason Creek in 2002. Data for the gage is located at https://fortress.wa.gov/ecy/wrx/wrx/flows/station.asp?sta=45J07. The average flow for the period of record from 2002 to 2008 is provided in Figure 3. In addition the flow for a drought year, 2005, is shown on the figure. The annual high flows generally occur in response to snowmelt in May and June and average about 1,500 cfs. The lowest flow occurs in late summer and early fall and range from 40 to 50 cfs. However in a dry year, such as 2005, flows dropped to a low of 17 cfs.

Grant PUD installed a Hobo type pressure transducer in Nason Creek at the Boyce site. The pressure transducer measured the depth of water at that location. Although information was not collected to prepare a rating curve of depth vs. flow at the site the depth information is useful in reviewing impacts determined by the groundwater model described in Section 4. Figure 4 provides the pressure transducer data collected.

## GROUNDWATER EXPLORATION PROGRAM

A groundwater exploration program was started at the Cascade Gardens site. Two test wells were drilled in 2006 at that site. A geophysical investigation was performed in 2006 by Golder Associates to review the geology at the Cascade Gardens and Boyce sites and help guide the drilling program at the Boyce site. In 2007, a test well was completed at the Boyce property and in 2008 a test well completed at the Youngsman site. A description of those wells follows; Figure 5 shows the location of the wells.

## Cascade Gardens Test Wells

Two 12-inch wells were constructed at the Cascade Gardens site. Both wells were completed to a depth of 120 feet below ground surface (bgs). The formations found in the wells were primarily sand, silty gravel and gravels; however Well 2 had heaving sands. Well 1 had a static water level of 34 feet bgs. A screen was installed in a sand and gravel formation from 95 to 115 ft bgs and a short pump test performed. A pumping rate of 50 gpm caused a 50 foot drawdown and the pump test was stopped as sufficient flow was not obtained. Figure 6 shows the drawdown experienced during the test. Figure 7 shows the change in aquifer level during the pump test at the domestic well located approximately 90 feet from Well 1. Well 2 had a static water level of 20 ft bgs, no screen was installed because of the limited flow obtained from Well 1. The well logs for these two wells are provided in Appendix A.

## Geophysical Investigation

Golder Associates was retained through Anchor QEA to perform a geophysical investigation of the Cascade Gardens and Boyce sites. The geophysical investigation is provided in Appendix B. Two seismic reflection lines were run; one between Well 1 and 2 at the Cascade Gardens site and one starting at Nason Creek and running through most of the Boyce property.

Golder interpreted the seismic data at the Cascade Gardens site as showing a thick sand unit underlying the reflection line between Well 1 and 2. Below the bottom of Well 1, they believe there would be unconsolidated layers of sand and gravel. Below Well 2, they believe there would be a thick deposit of "heavy" sand underlain by unconsolidated layers of sand and gravel. They recommended that Well 1 be deepened if further exploration for water supply is carried out.

On the Boyce property, Golder interpreted the data to show an upper layer of silt and clay down to about 135 feet bgs and three layers representing interbedded silt, sand and gravel deposits below the silt and clay. They interpreted the top of bedrock to be 250 to 280 ft bgs. A fault was found near the east end of the seismic line which corresponds to a major fault shown on geologic maps. They believed a well drilled on the Boyce site would encounter coarse-grained sediments between 150 feet and 250 feet bgs but a relatively thick layer of silt may affect infiltration of water to deeper gravels.

## Boyce Property Well

This 12-inch well was drilled to a total depth of 275 ft where it encountered bedrock, the approximate depth interpreted in the geophysics investigation. The formations found were primarily silty sands and clay, but a sand and gravel layer was found from 245-254 ft bgs. Unfortunately the casing became stuck and could not be pulled back to install a screen and no pump test could be performed. The well was abandoned. The well log for this well is provided in Appendix A.

## Youngsman Property Well

A 6-inch test well was drilled to a depth of 178 feet. The formations encountered were fine sands and gravels, silty sands and gravel and clay. Sand and gravel layers were found at 106-135 feet bgs which looked most promising. The static water level was 29.5 ft bgs. A screen was set between 115 and 130 ft bgs and a 12-hour pump test performed. The well log is provided in Appendix A.

### *Results of Youngsman Pump Test*

The pump test rate was 206 gpm; the maximum drawdown during the test was 32.5 ft. Figure 8 shows the results of the pump test and recovery period. The test results indicate the specific capacity of well is 6.3 gpm/ft drawdown. The estimated available drawdown from the static water level is 85 feet; therefore the potential yield of a well at that location is 535 gpm.

Aquifer properties were estimated from the pump test however no nearby monitoring wells were available (the closest well was about 2000 ft away) and additional pump tests will need to be performed when an additional well is drilled to confirm those properties. The aquifer properties were estimated using the Theis method with AquiferTest Pro software and are summarized in Table 1. An aquifer thickness of 29 feet was used for the calculations. The tansmissivity value is estimated to be 1,910 $ft^2$/day (14,300 gallons per day/ft) and 65.9 ft/day (493 gallons per day per square foot) for hydraulic conductivity. The storage coefficient is estimated to be 0.00014. Appendix C provides summary information for the aquifer test.

**Table 1**
**Aquifer Properties**

| Transmissivity ($ft^2$/day) | K (ft/day) | Storage Coefficient |
|---|---|---|
| $1.91 \times 10^3$ | $6.59 \times 10^1$ | $1.14 \times 10^{-4}$ |

The recovery period was monitored and aquifer properties estimated using the Agarwal method, also with the AquiferTest Pro software. The estimated transmissivity is 1580 $ft^2$/day (11,800 gallons per day/ft) and 5.4 ft/day (40.7 gallons per day per square foot) for hydraulic conductivity. The storage coefficient was calculated to be much less than the pump test coefficient at $2 \times 10^{-15}$. These aquifer properties will be revisited with additional pump tests using a monitoring well on the site.

## POTENTIAL EFFECTS ON NEARBY WELLS AND NASON CREEK

To determine effects on nearby wells from the potential drawdown of the aquifer (cone of depression), the following data is needed:

- Pumping rate of production wells
- Aquifer areal extent, depths, thicknesses
- Aquifer properties
- Location of nearby wells and their depth and aquifer layer they are drawing from
- Location of streams and aquifer boundaries that restrict flow

To determine the effect on Nason Creek and other nearby water bodies, streamflow and flow depth information is needed as well as the hydraulic conductance of the streambed.

A groundwater model was determined to be the best method of determining impacts as it can quickly review different scenarios of pumping rates and pumping locations. The groundwater model used was the USGS Modflow model. The model is a modular finite difference groundwater flow model, is an open source model and is the most commonly used groundwater model.

## Discussion of Groundwater Model

The groundwater model was developed using stratigraphy obtained from well logs. The well logs were located using best possible information (addresses, lot numbers, names on tax parcels) and the elevation of the top of the well estimated using the Lidar topographic data. The water levels at each well were estimated using water levels recorded on the well logs and the estimated elevations of the top of the well. Sediment layers were identified and input into a database and the stratigraphy of the Nason Creek valley determined. Figure 9 and 10 show the stratigraphy developed from the well logs. The Modflow model used a grid cell size of 250 feet. Figure 11 shows the grid cells used in the model as well as the wells with water levels that were used in the calibration of the model. Aquifer properties used in the model were first estimated from the Youngsman pump test and from typical values from literature and then adjusted to calibrate the model. Figure 12 shows the model predicted aquifer heads (water levels) versus observed from well logs. The modeling should be viewed as being preliminary in nature as the well elevations are estimated and the information available about aquifer properties is limited. However the model results can be used to guide the groundwater investigations towards feasible scenarios of groundwater pumping. Additional field data should be collected if the groundwater model is to be used for more precise estimates of impacts to nearby wells and Nason Creek.

Assuming each well capacity is limited to 535 gpm (as determined in the Youngsman pump test) we ran scenarios in the model using multiple wells with pumping rates less than 535 gpm. Model simulations with 2,400 gpm pumping rate produced dry cells suggesting that the aquifer drawdown is likely to extend below the elevation of the screen in the Youngsman well and will likely dry up the aquifer. The pumping rate would not be sustainable and even if so, would cause large impacts to nearby wells. We decided to focus on smaller pumping rates to arrive at a scenario with reasonable drawdowns and minimal effects on nearby wells and on the water level in Nason Creek. Pumping rates of 1500, 1250 and 600 gpm were modeled. The model calculates aquifer drawdown which are uniform over a grid cell i.e. the model does not maintain a gradient within a cell, but rather only between the cells. Thus, some accuracy is lost due to discretization. To accurately reflect actual conditions observed during a pump test the model grid will have to be infinitesimally small. However, this is computationally infeasible. Thus, the drawdown observed in the vicinity of a well during a pump test is likely to be greater than the computed aquifer drawdown. However, the

drawdowns simulated by the model over the area will be generally representative of actual drawdowns. For example, the drawdown in the Youngsman test well was 32.5 feet at a pumping rate of 206 gpm measured within the well casing which is greater than the aquifer drawdown computed in the model for higher pumping rates within the grid cell (dimensioned 250 ft by 250 ft) where pumping was simulated.

### *Results for 1500 GPM Pumping Rate*

For this scenario, pumping from 3 wells strung between the Youngsman and Cascade Gardens properties was simulated. Each well pumped at 500 gpm to spread effects out over a wider area. The maximum aquifer drawdown was computed to be over 50 ft (see Figure 13) and covers a wide area. This pumping rate could not be sustained without causing severe impacts to nearby wells.

### *Results for 1250 GPM Pumping Rate*

For this scenario, pumping from 5 wells strung between the Youngsman property and the Cascade Gardens properties was simulated. Note that Grant PUD does not own those other properties. Each well was pumped at 250 gpm to spread effects out over a wider area. The maximum drawdown was similar to the 1500 gpm case; it was also estimated to be over 50 ft (see Figure 14) and covers a wide area. This pumping rate could not be sustained without causing severe impacts to nearby wells.

### *Results for 600 GPM Pumping Rate*

For this scenario, pumping from 2 wells on opposite ends of Youngsman property was simulated. The pumping rate was 300 gpm for each well. The aquifer drawdown is estimated to be 8 ft, which appears to be manageable and probably would not cause significant effects on nearby wells. Figure 15 shows the estimated drawdown in the project area. Because the scale of the color gradient (drawdown) is the same as for the 1250 and 1500 gpm cases, the figure does not clearly show the smaller drawdown expected.

The model also estimated the potential effect on Nason Creek flow. A sensitivity analysis of the potential impacts to Nason Creek was performed by varying the hydraulic conductivity of the stream bed for various model runs. A model run with a high hydraulic conductance of

the Nason Creek streambed (very conservative assumption) showed a very small difference in stream level (0.01 ft) and therefore streamflow from pumping 600 gpm on the site. The reason for the small effect is likely the layers of silt and clay underlying the streambed between the creek and the location of the pumping wells which confines the aquifer. Downstream from the site (and point of discharge of the groundwater), streamflow will increase by the pumping rate discharged into Nason Creek.

### Summary of Groundwater Modeling

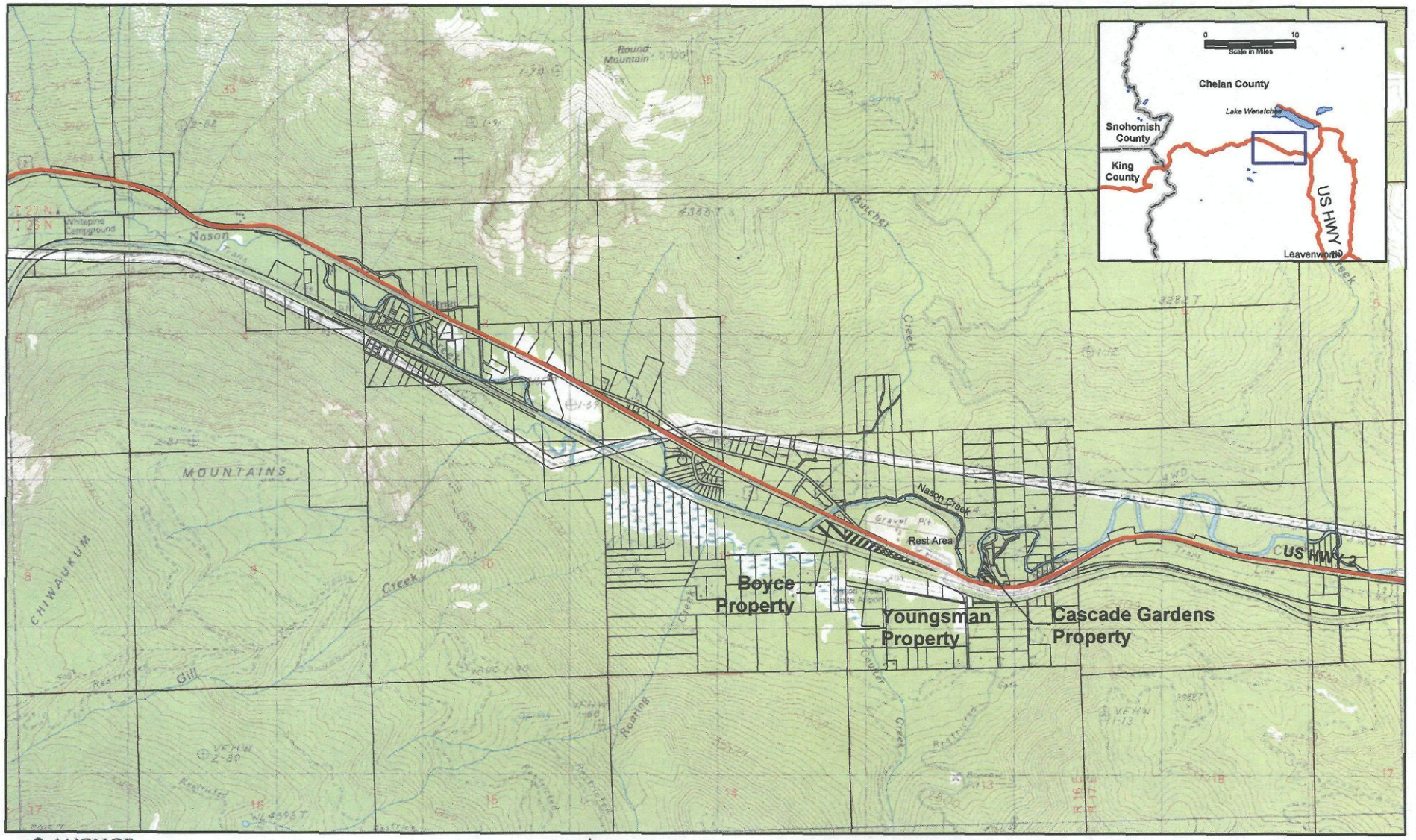
The potential effect on nearby wells varies with pumping rate. A pumping rate of 600 gpm at the Youngsman site will produce an estimated 8 ft drawdown in nearby wells. A pumping rate of 1500 gpm will produce an estimated 70 ft drawdown. The 600 gpm pumping rate is likely the maximum rate that can be sustained for the Youngsman site without producing adverse effects on nearby wells. That rate also produced negligible effects on Nason Creek upstream from the site.

Additional pump tests will need to be performed to confirm the maximum pumping rate. The rate may increase or decrease however we would not expect much change in the maximum rate based upon the results of the first pump test.

## RECOMMENDATIONS

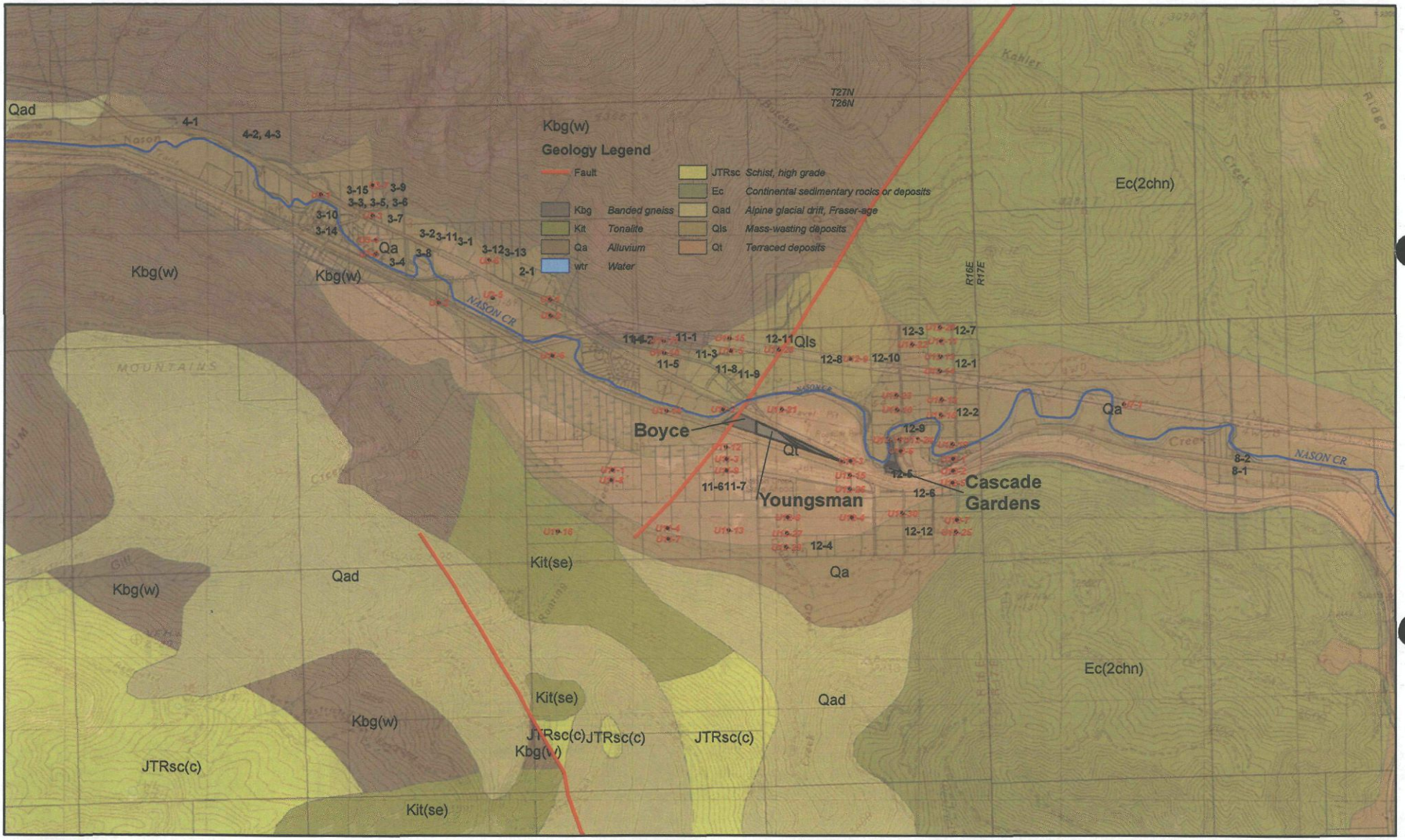
The next steps for this groundwater exploration program will be to drill and test another well on the Youngsman property. The well should be a larger production well capable of at least 300 gpm. An additional pump test will need to be performed using the existing test well as a monitoring well. The results of the analysis of impacts to nearby wells and Nason Creek should be updated with the results of that pump test.

A Water Rights Application to Department of Ecology should also be made to start the process of obtaining a groundwater right for the facilities.




ANCHOR QEA

Figure 1
Site Location Map




ANCHOR QEA

Figure 2
Nason Creek Geology
and Well Log Locations

**Figure 3**
**Nason Creek Flows at Ecology Gage**

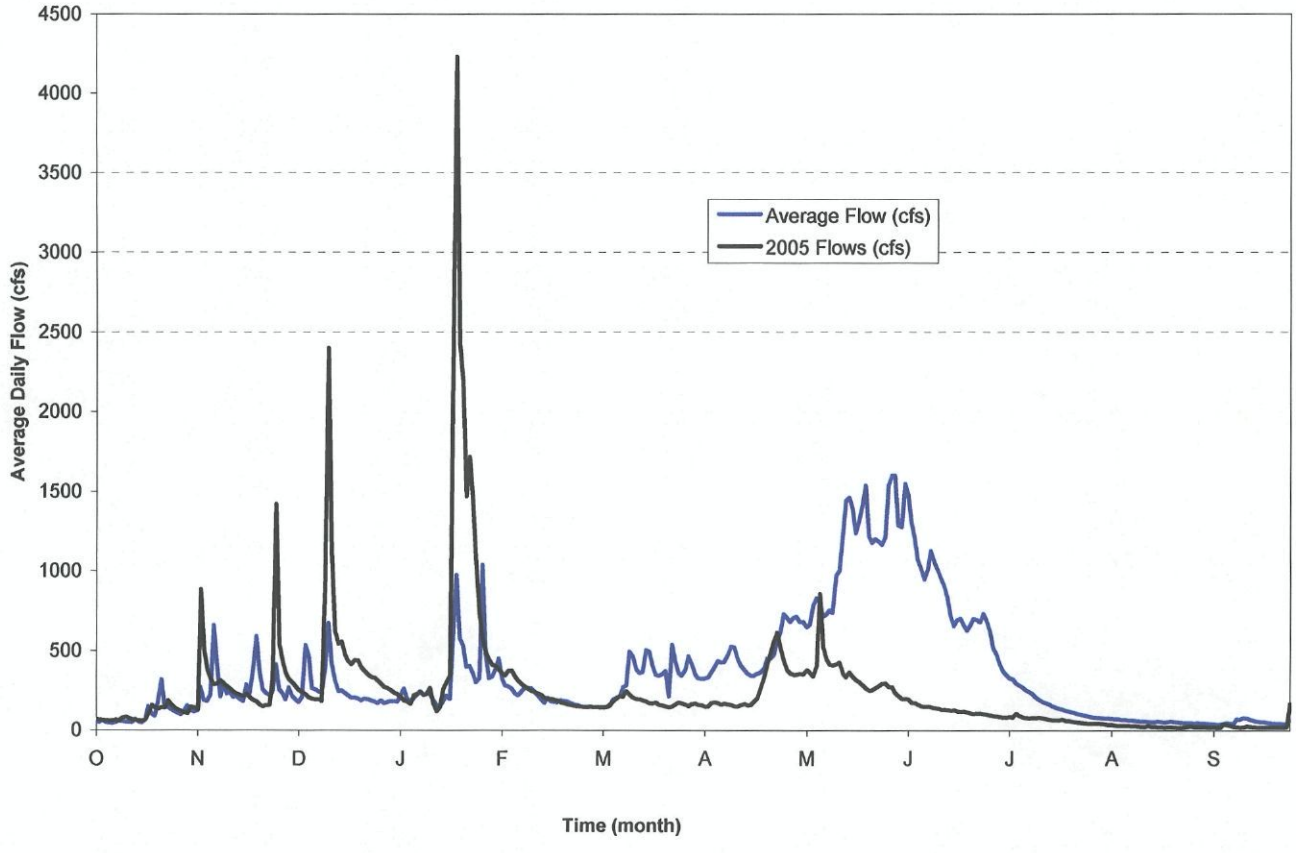
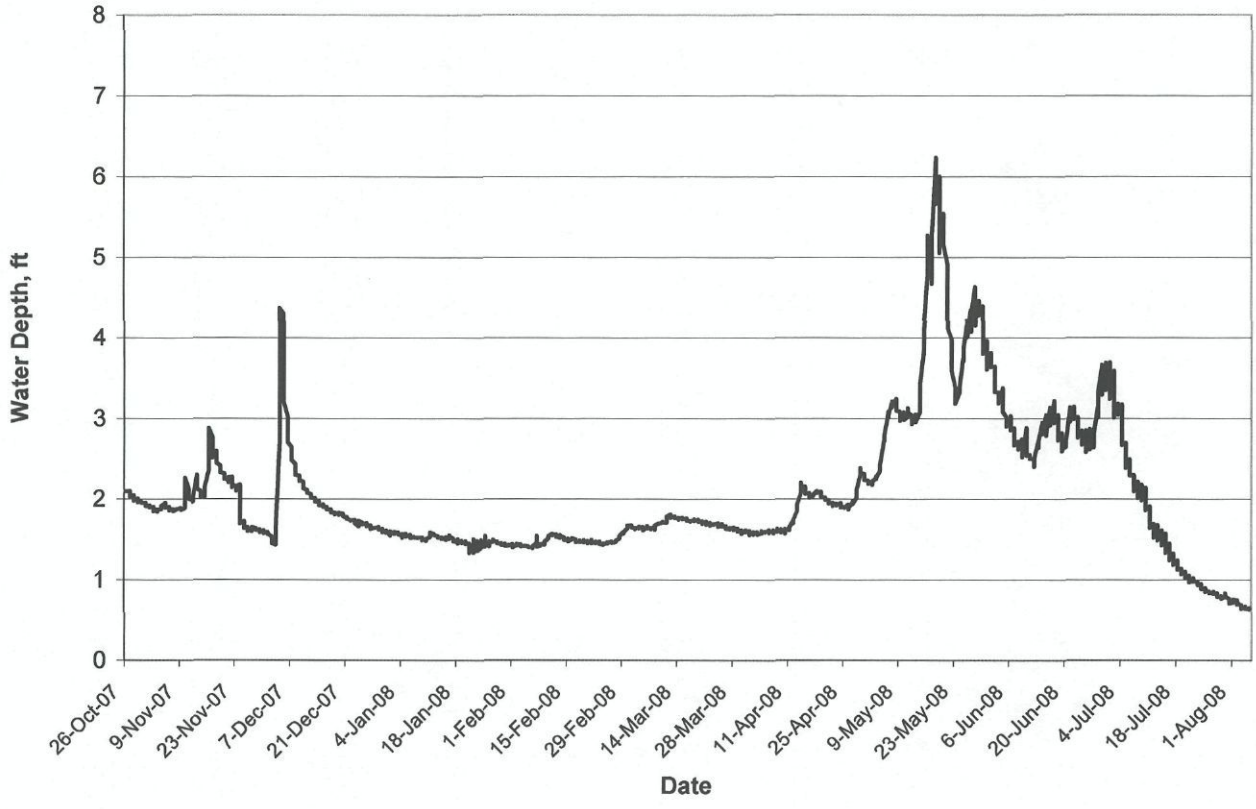


**Figure 4**

**Water Depths in Nason Creek at Boyce Site**



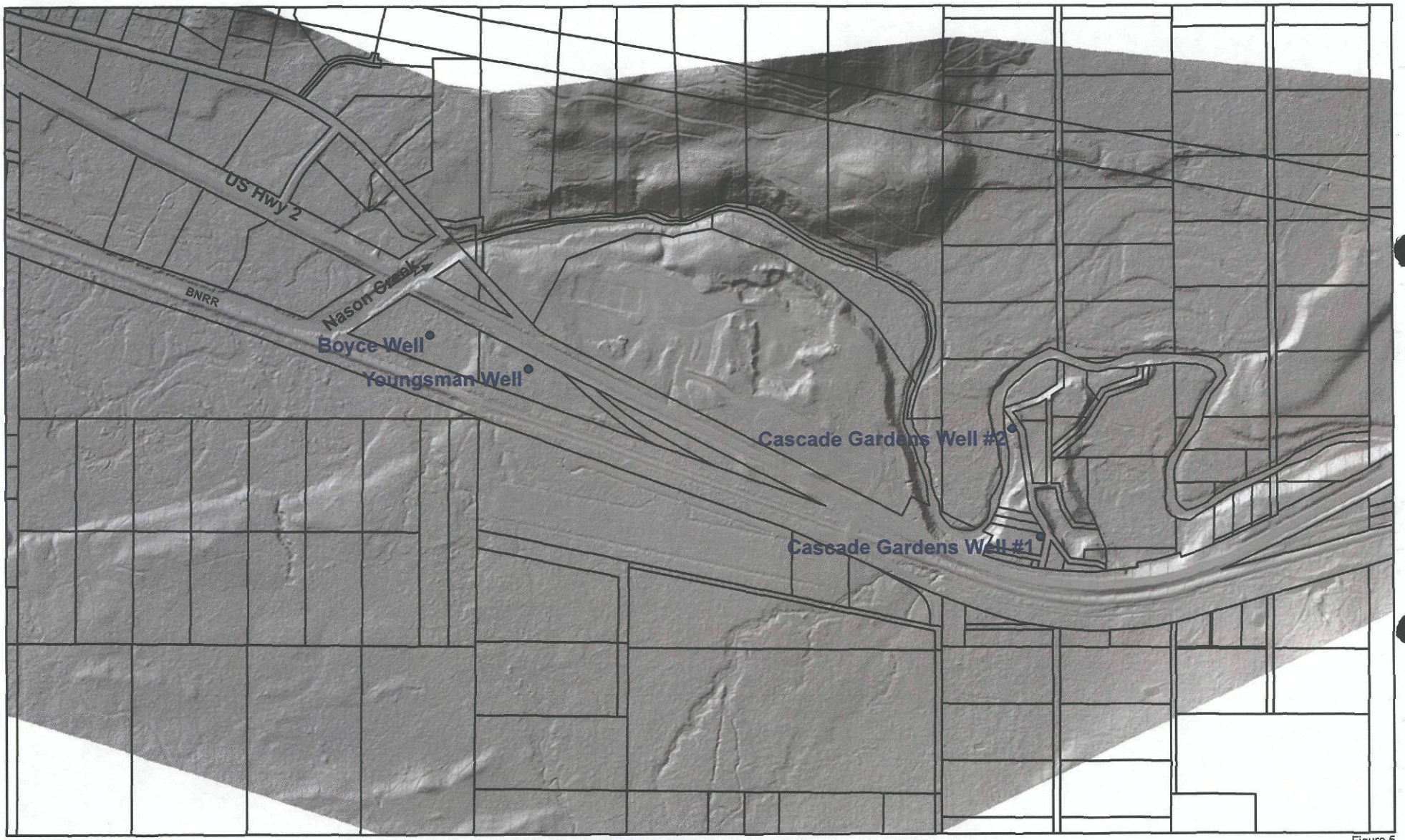



Figure 5
Well Locations
and Lidar Map

**Figure 6**

**Pump Test Results from Cascade Gardens Site – Well 1**

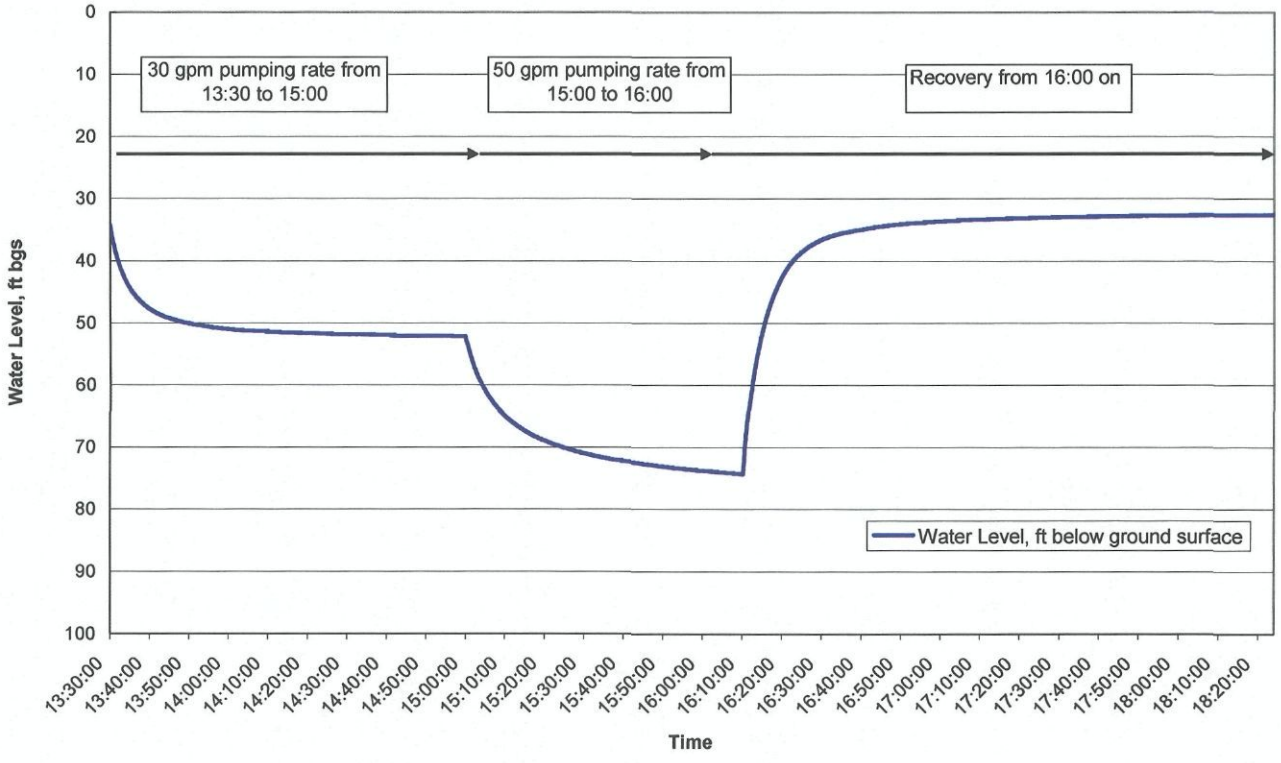


**Figure 7**

**Observation Well Hydrograph at Cascade Gardens Site**

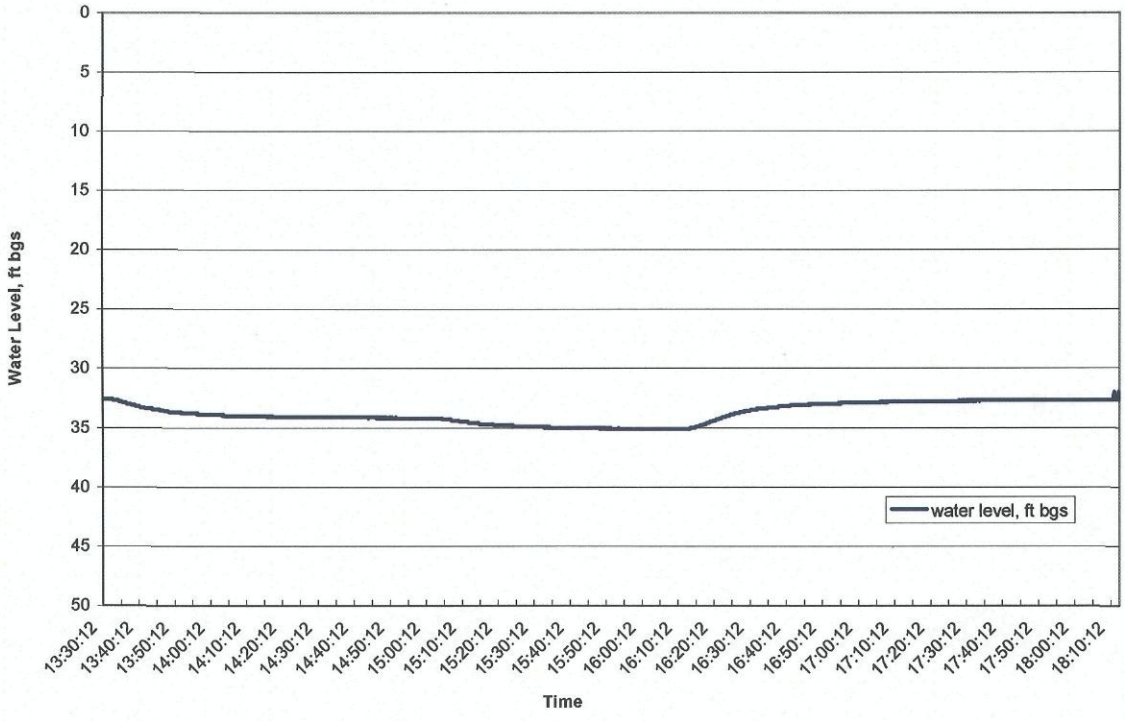
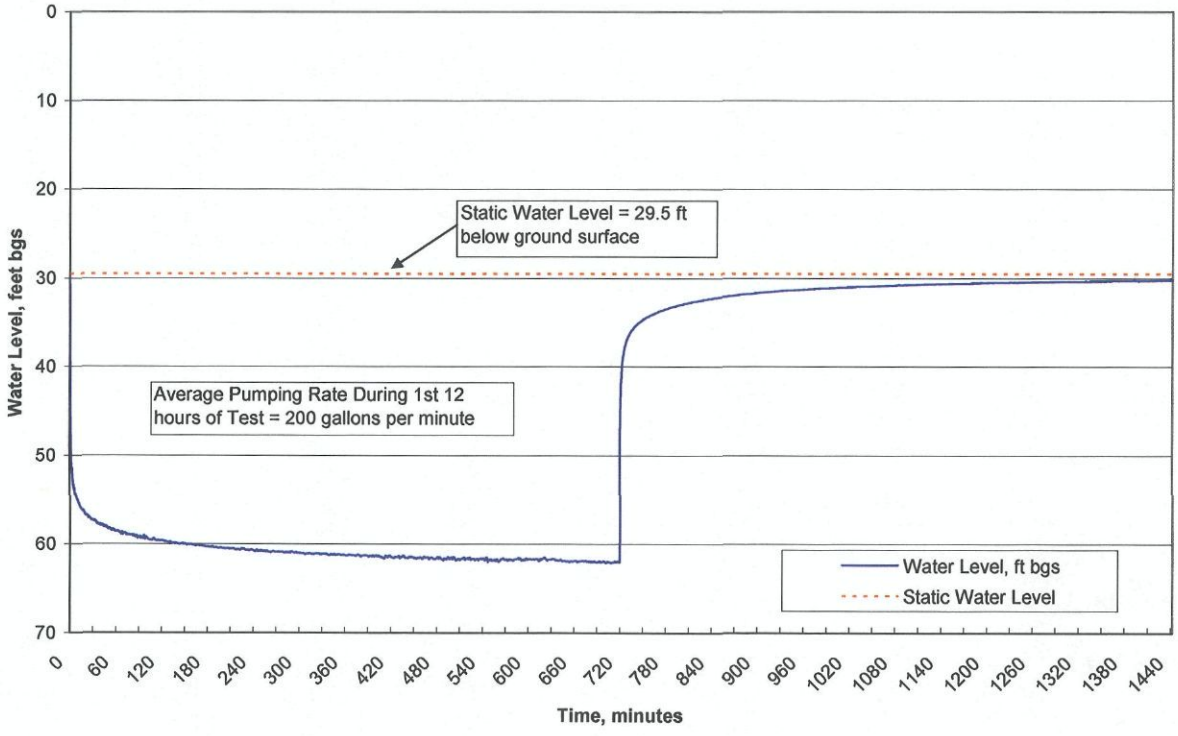


**Figure 8**

**Youngsman Well Pump Test Results Oct 2-3, 2008**



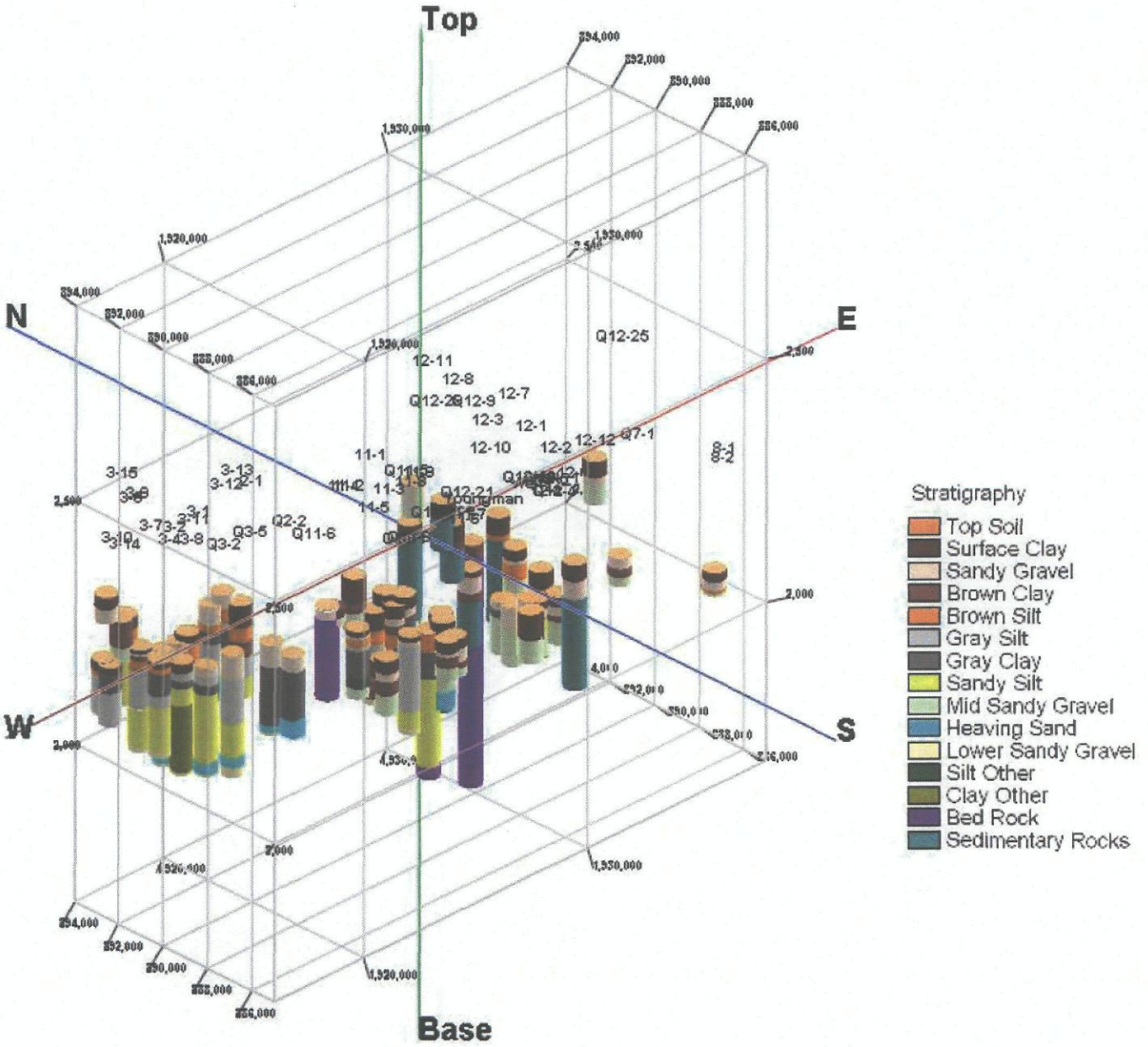



**Figure 9**

**Stratigraphy from Well Logs**

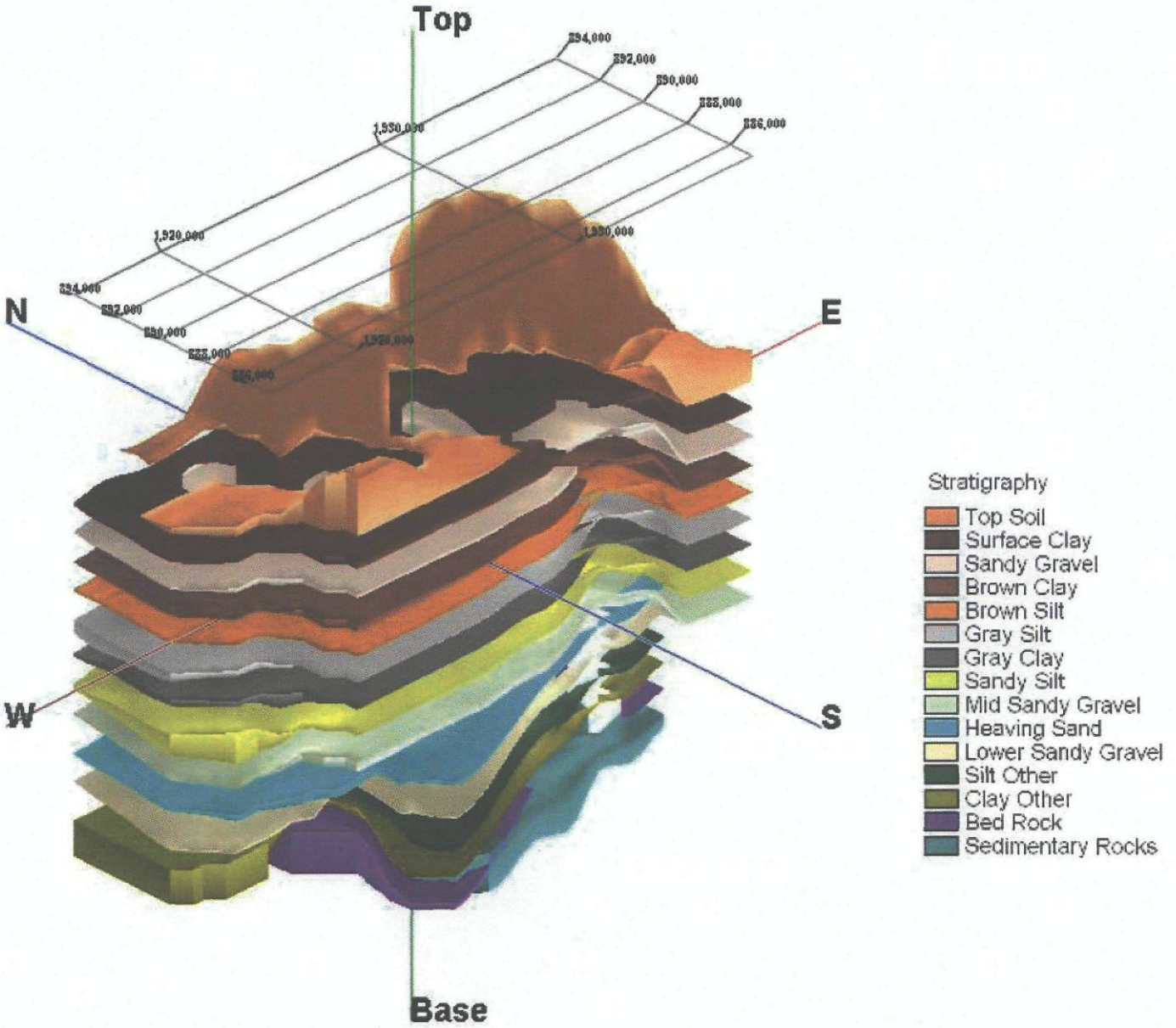
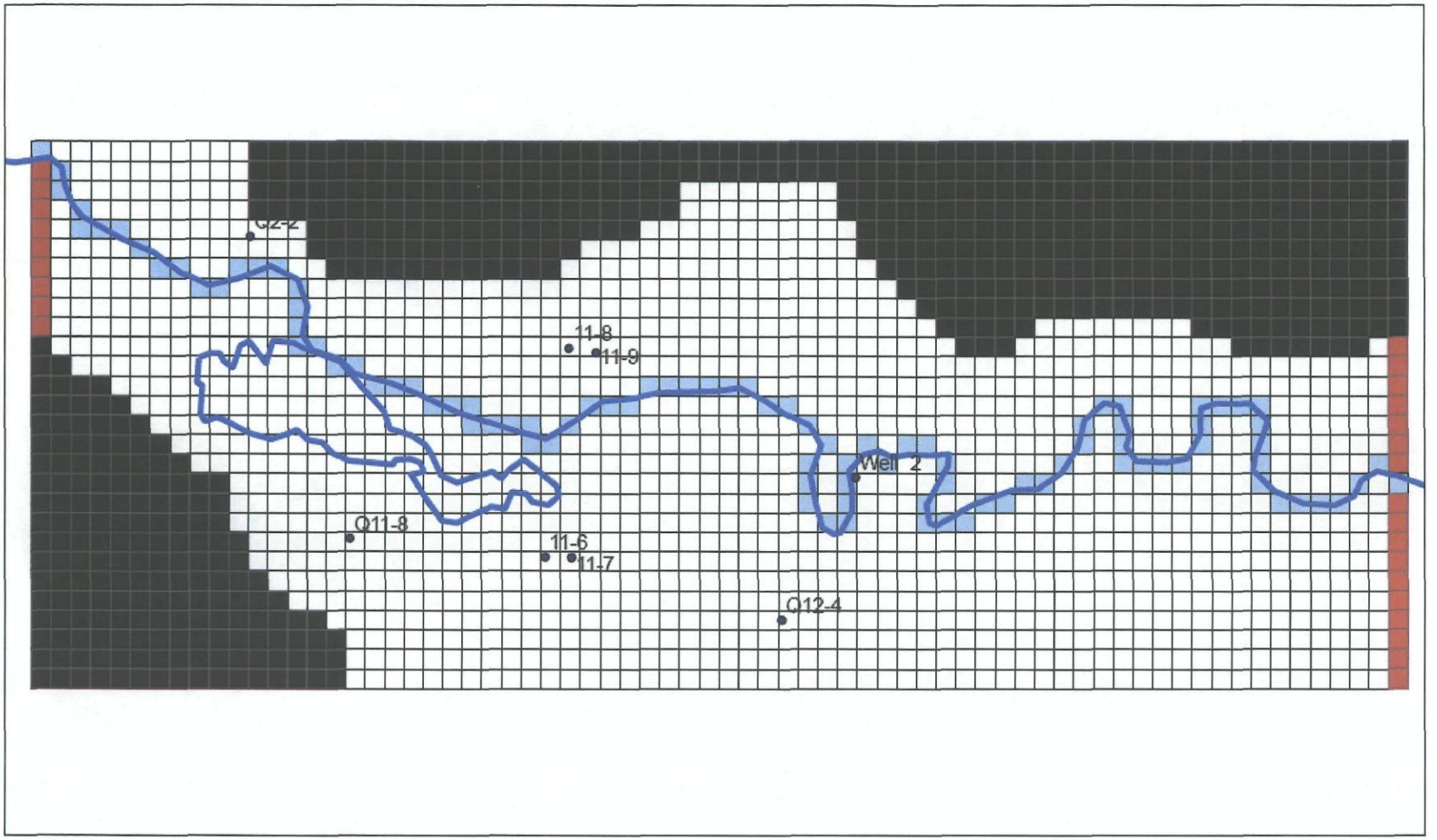
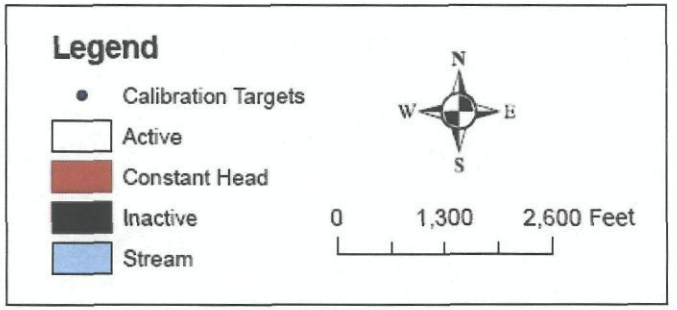



**Figure 10**

**Interpreted Stratigraphy**



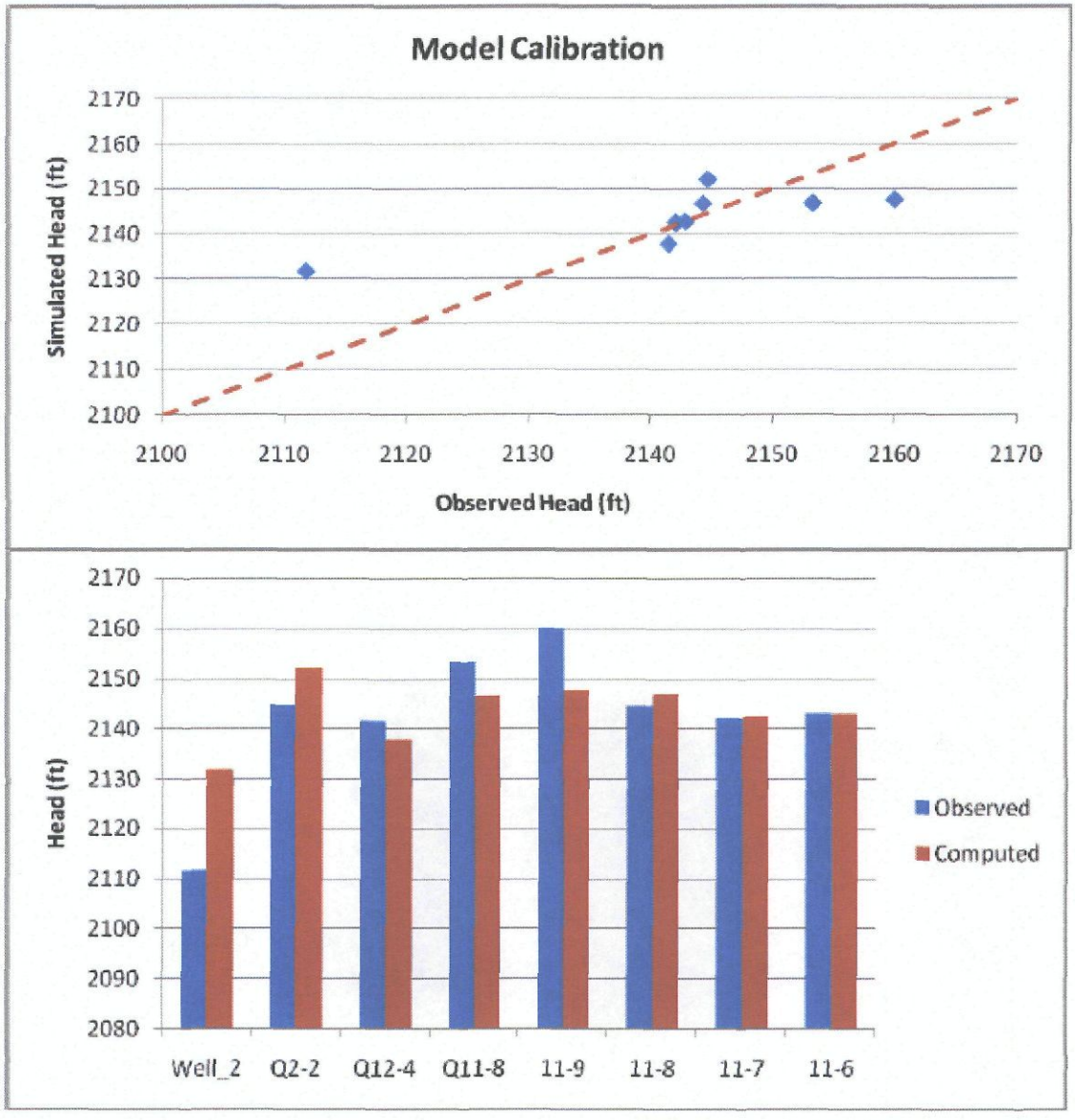

**Nason Creek Groundwater Model - Boundary Conditions and Calibration Target Locations**




PM - \\Pradeep\D_Drive\GrantPUD\nason_creek\Analysis\GIS\nason_creek_gwv_model.mxd

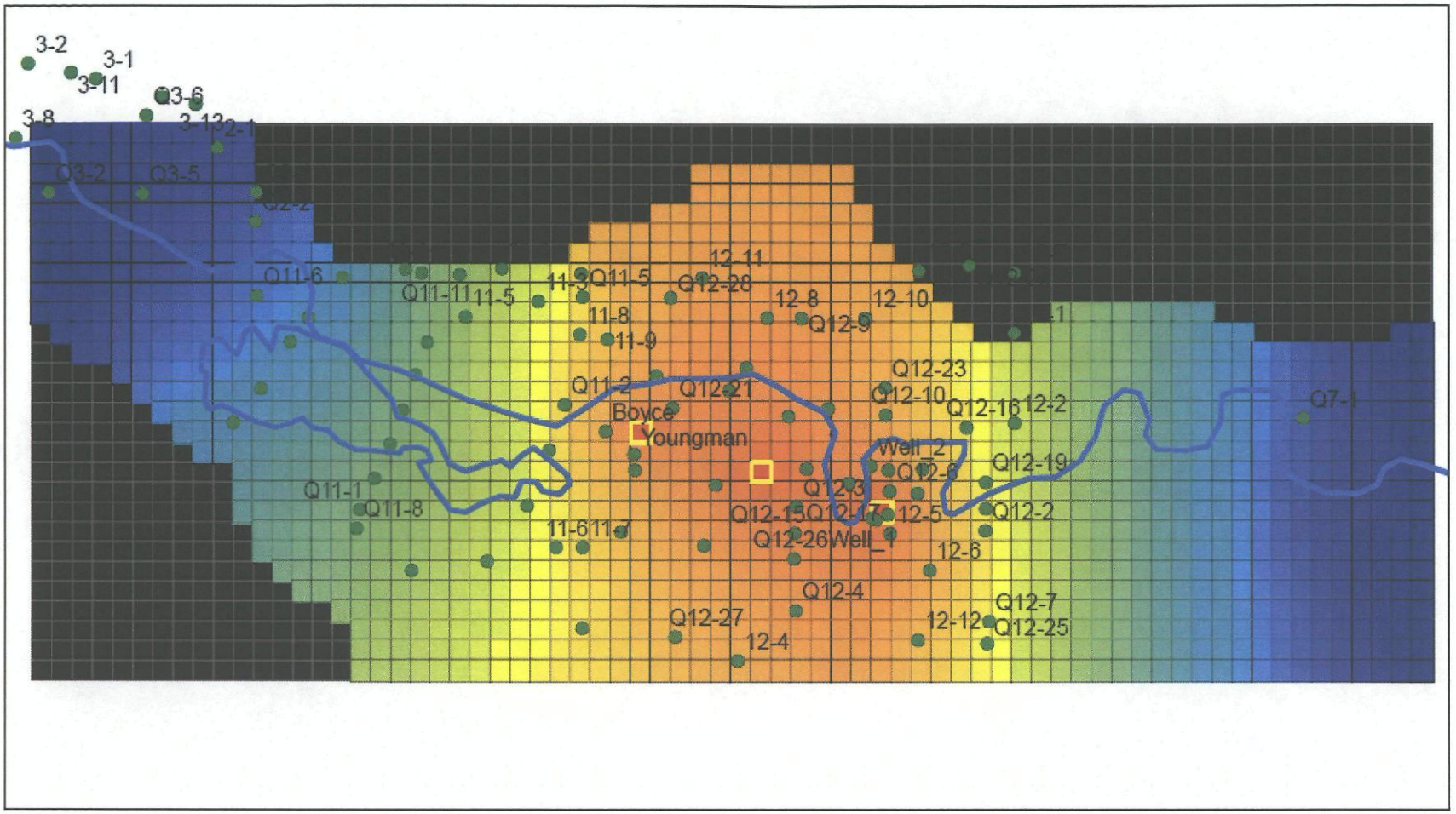
**Figure 11**

**Modflow Model Grid**




**Hydraulic Conductivity for Streambed = 100 ft/d (all other parameters same as previous simulation)**

**Figure 12**
**Model Calibration**




**Nason Creek Groundwater Model - Simulated Drawdowns in Layer 11 with a Pumping Rate of 500 gpm at Three Location**

*Streambed conductivity set to 0.001 ft/d.*

*Maximum drawdown simulated by model = 70.45 ft.*

*At 500 gpm, only 3 pumps could be reliably simulated in the model without drying out the pumping location; model simulation with 5 pumps produced dry cells at pumping locations.*

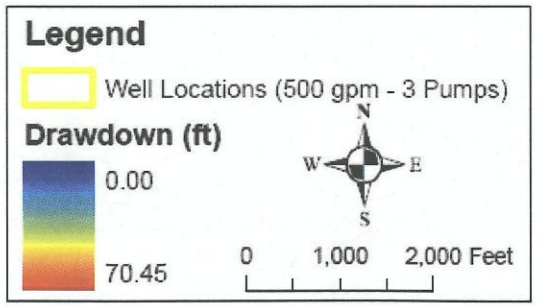
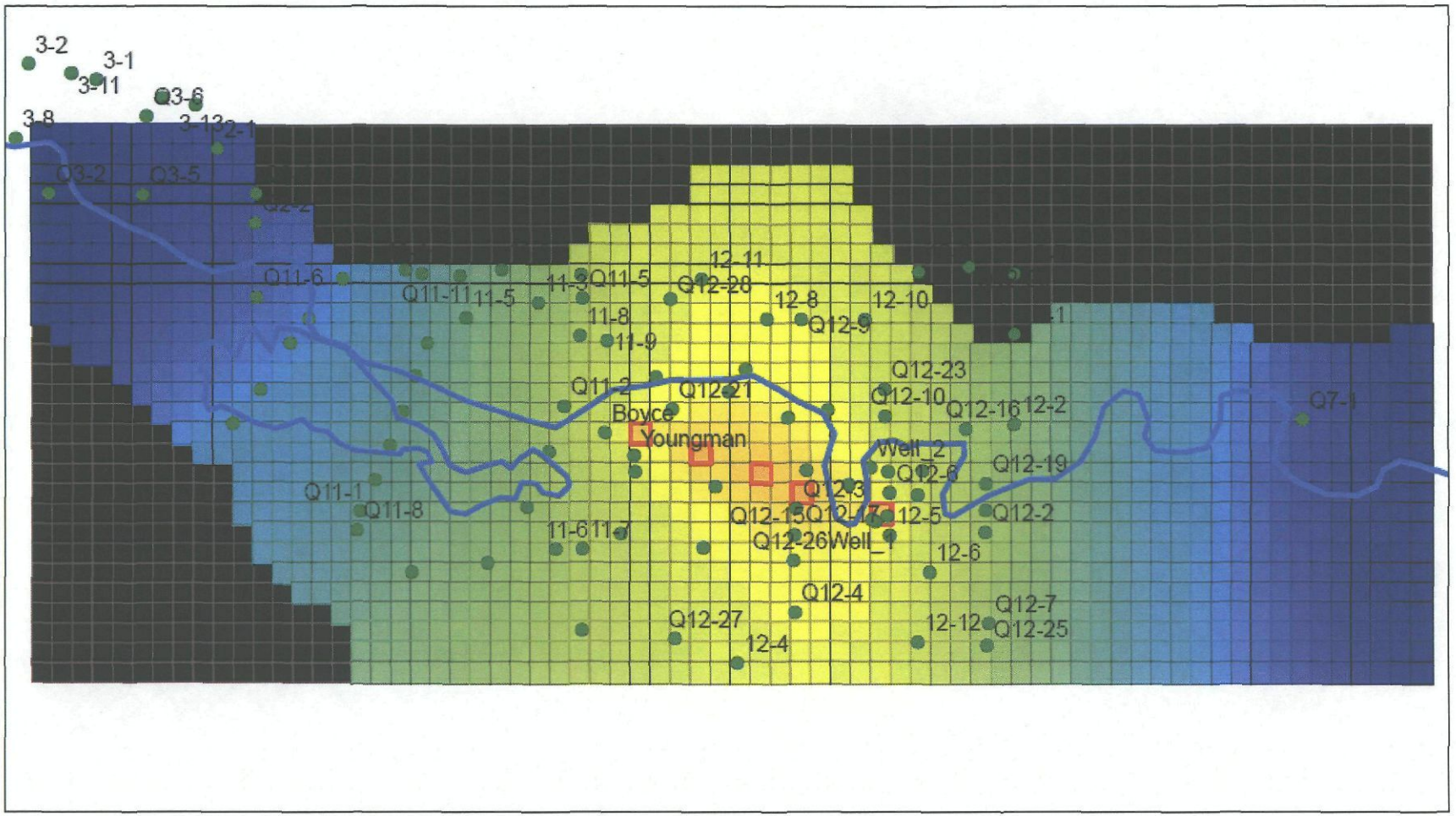



**Figure 13**

**1500 GPM Pumping Scenario**



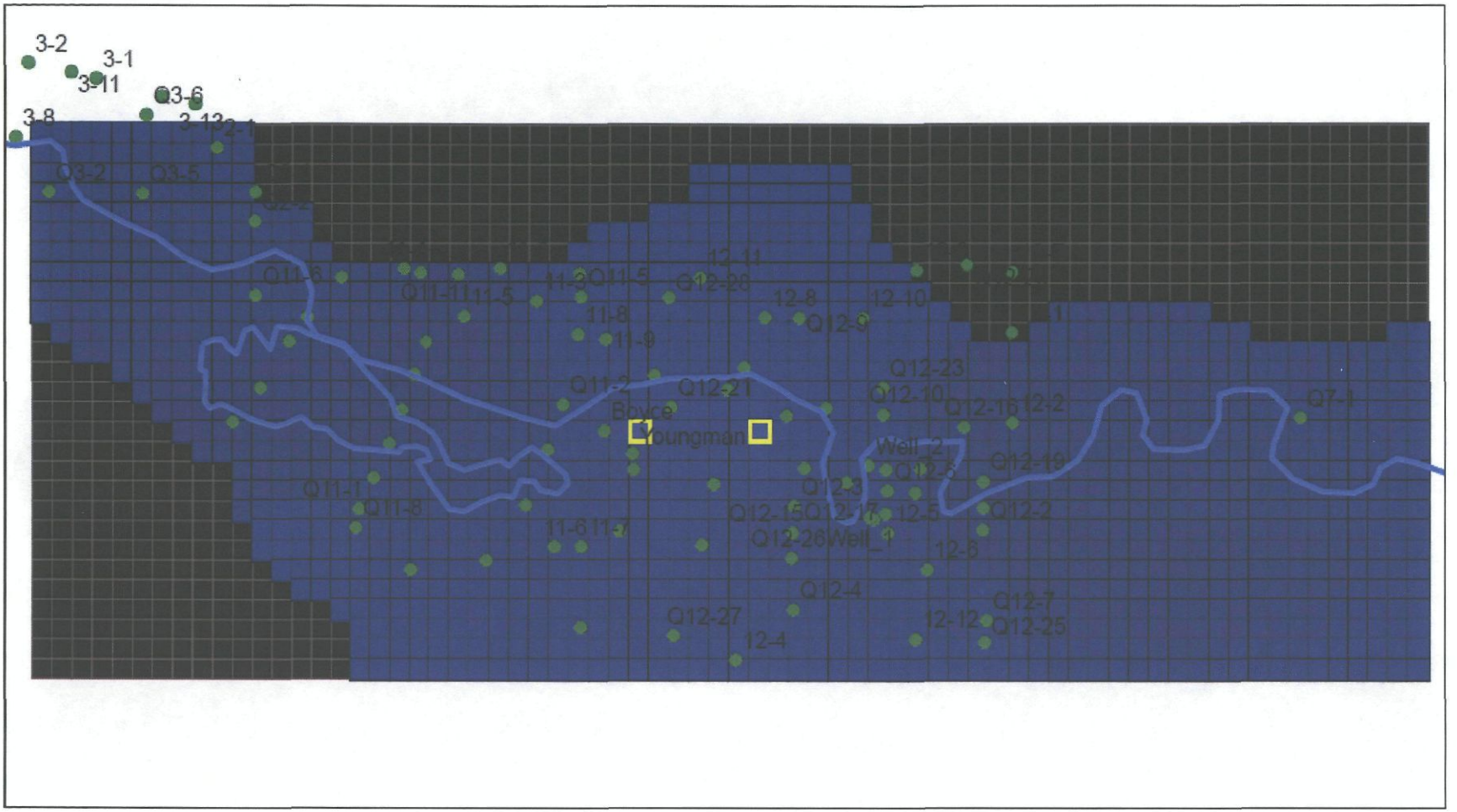

**Nason Creek Groundwater Model - Simulated Drawdowns in Layer 11 with a Pumping Rate of 250 gpm at Five Locations**

*Streambed conductivity set to 0.001 ft/d.*

*Maximum drawdown simulated by model = 54.59 ft.*

**Figure 14**

**1250 GPM Pumping Scenario**




**Nason Creek Groundwater Model - Simulated Drawdowns in Layer 11 with a Pumping Rate of 300 gpm at Two Locations**

*Streambed conductivity set to 100 ft/d.*

*Maximum drawdown simulated by model = 8.37 ft.*

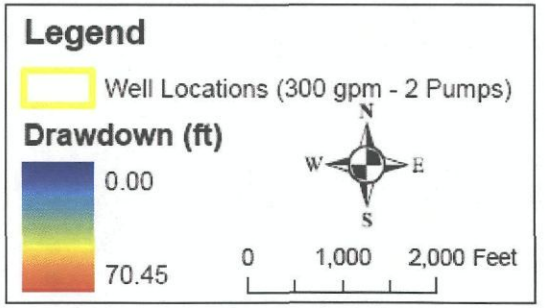



**Figure 15**

**600 GPM Pumping Scenario**

# APPENDIX A
# WELL LOGS

NASON CREEK WELL LOGS
BOYCE, YOUNGSMAN, & CASCADE GARDENS

Please print, sign and return to the Department of Ecology

Boyce Well Log

# Water Well Report

Original – Ecology, 1st copy – owner, 2nd copy – driller

Construction/Decommission 295071

☒ Construction
☐ Decommission ORIGINAL INSTALLATION Notice of Intent Number _____

Current Notice of Intent No. UCE 07450

Unique Ecology Well ID Tag No. AEG 331

Water Right Permit No. _____

Property Owner Name Grant County PUD

Well Street Address 19 mi. W of Leavenworth WA

City Leavenworth County USH 98826

Location NE 1/4 1/4 SE 1/4 Sec 11 Twn 26 R 17 EWM or WWM ☒ circle one

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

Tax Parcel No. 26-17-11140020

PROPOSED USE: ☐ Domestic ☐ Industrial ☒ Municipal ☐ DeWater ☐ Irrigation ☒ Test Well ☐ Other _____

TYPE OF WORK: Owner's number of well (if more than one) _____

☒ New well ☐ Reconditioned ☐ Deepened Method: ☐ Dug ☐ Bored ☐ Driven ☒ Cable ☐ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 12 inches drilled +2 ft. Depth of completed well 265 ft.

CONSTRUCTION DETAILS

Casing installed: ☐ Welded 12" Diam. from +2 ft. to 273 ft. ☐ Liner installed _____" Diam. from _____ ft. to _____ ft. ☐ Threaded _____" Diam. from _____ ft. to _____ ft.

Perforations: ☐ Yes ☒ No

Type of perforator used _____

SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.

Screens: ☒ Yes ☐ No ☒ K-Pac Location _____

Manufacturer's Name Alloy Machine Works

Type 10" pipe size Model No: _____

Diam: 10" Slot size 100 from 245 ft. to 260 ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/filter packed: ☐ Yes ☐ No ☒ Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 20 ft.

Material used in seal Bentonite

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? _____ Depth of strata _____

Method of sealing strata off _____

PUMP: Manufacturer's Name _____

Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.

Static level 201 ft. below top of well Date _____

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☒ No If yes, by whom? _____

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

| Time | Water Level | Time | Water Level | Time | Water Level |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

Date of test _____

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest _____ gal./min. with stem set at _____ ft. for _____ hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water _____ Was a chemical analysis made? ☐ Yes ☐ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. Indicate all water encountered. (USE ADDITIONAL SHEETS IF NECESSARY.)

| MATERIAL | FROM | TO |
|---|---|---|
| Top Soil | 0 | 2 |
| Black Sand & Silt | 2 | 40 |
| Gray Hard pan | 40 | 94 |
| Brown Silty Sand & Gravel | 94 | 96 |
| Gray Silty Sand | 96 | 245 |
| Light Sand & Gravel | 245 | 254 |
| Silty Sand | 254 | 265 |
| Silt (Gray) | 265 | 275 |
| Bed Rock | 275 | |

RECEIVED
OCT 02 2008
DEPARTMENT OF ECOLOGY - CENTRAL REGIONAL OFFICE

Start Date 9/10/07 Completed Date 11/07/2007

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Driller/Engineer/Trainee Name (Print) Dave Simmons

Driller/Engineer/Trainee Signature _____

Driller or trainee license No. 2860

Drilling Company Irrigation Technology & Control

Address 4956 Contractors Drive

City, State, Zip East Wenatchee WA 98802

Contractor's Registration No. IRRIGTC08403 Date 3/13/08

IF TRAINEE,
Driller's Licensed No. _____
Driller's Signature _____

Ecology is an Equal Opportunity Employer.

EGY 050-1-20 (Rev.2/03)

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

YOUNGMAN PROPERTY WELL

Youngsman Well Log

# WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

**Construction/Decommission** *("x" in circle)*

(•) Construction

( ) Decommission *ORIGINAL INSTALLATION Notice of Intent Number* _____

**CURRENT**

Notice of Intent No. W 268520

Unique Ecology Well ID Tag No. BAP 020

Water Right Permit No. _____

Property Owner Name Grant County P.U.D.

Well Street Address Hwy 2 (Across from rest area) - Youngman Prop.

City Leavenworth County Chelan

Location SW 1/4-1/4 NW 1/4 Sec 12 Twn 26 R 16 EWM or WWM [x] check one

(Lat/Long (s, t, r Still REQUIRED) Lat Deg N 47 Lat Min/Sec 46.046 Long Deg W 120 Long Min/Sec 47.981

Tax Parcel No. P.U.D.

**PROPOSED USE:** [x] Domestic [ ] Industrial [ ] Municipal [ ] DeWater [ ] Irrigation [ ] Test Well [ ] Other _____

**TYPE OF WORK:** Owner's number of well (if more than one) _____

[x] New well [ ] Reconditioned *Method:* [ ] Dug [ ] Bored [ ] Driven [ ] Deepened [ ] Cable [x] Rotary [ ] Jetted

**DIMENSIONS:** Diameter of well 6 inches, drilled 178 ft. Depth of completed well 141 ft.

**CONSTRUCTION DETAILS**

Casing installed: [x] Welded 6 " Diam. from +2 ft. to 113 1/2 ft. [ ] Liner installed _____ " Diam. from _____ ft. to _____ ft. [ ] Threaded _____ " Diam. from _____ ft. to _____ ft.

Perforations: [ ] Yes [x] No

Type of perforator used _____

SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.

Screens: [x] Yes [ ] No [x] K-Pac Location 110 - 111

Manufacturer's Name *****

Type Stainless Steele Model No. _____

Diam. 5 Slot size .50 from 115 ft. to 125 1/2 ft.

Diam. 5 Slot size .30 from 125 1/2 ft. to 130 1/4 ft.

Gravel/Filter packed: [ ] Yes [x] No [ ] Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

Surface Seal: [x] Yes [ ] No To what depth? 23 ft.

Material used in seal Bentonite

Did any strata contain unusable water? [ ] Yes [x] No

Type of water? _____ Depth of strata _____

Method of sealing strata off _____

**PUMP:** Manufacturer's Name _____

Type: _____ H.P. _____

**WATER LEVELS:** Land-surface elevation above mean sea level 2199 ft.

Static level 29 1/2 ft. below top of well Date 09-25-08

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

**WELL TESTS:** Drawdown is amount water level is lowered below static level

Was a pump test made? [ ] Yes [x] No If yes, by whom? _____

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

*Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)*

| Time | Water Level | Time | Water Level | Time | Water Level |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

Date of test To be test pumped

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest 150+ gal./min. with stem set at 110 ft. for 3 hrs.

Artesian flow _____ g.p.m. Date 09-25-08

Temperature of water _____ Was a chemical analysis made? [ ] Yes [x] No

**CONSTRUCTION OR DECOMMISSION PROCEDURE**

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

| MATERIAL | FROM | TO |
|---|---|---|
| Brown clay, gravel, cobbles, boulders | 0 | 31 |
| Brown fine sand, gravel, rocks WB | 31 | 57 |
| Brown fine - coarse sand, gravel 30+ gpm | 57 | 60 |
| Brown cemented sand, gravel, rocks | 60 | 75 |
| Brown fine - coarse sand, gravel, rocks 34 gpm | 75 | 87 |
| Brown cemented sand, gravel | 87 | 106 |
| Heaving brown fine - med. sand, gravel | 106 | 135 |
| Heaving brown fine sand, silt, pea gravel, rocks | 135 | 142 |
| Heaving brown silty fine sand | 142 | 169 |
| Heaving brown silty fine sand, rocks | 169 | 174 |
| Heaving gray / brown silt, fine sand | 174 | 178 |
| | | |
| | | |
| | | |
| ***** | | |
| SCREEN info: .50 slot @ 130 1/4 - 138' | | |
| 8" packer, 4' 4" riser, 20' 11" of screens, | | |
| 5' tail. Total length = 30' 11" | | |
| | | |
| Developed w/ air for 3 1/2 hours with jetting tool. | | |

most productive layer

Start Date 09-19-08 Completed Date 09-25-08

**WELL CONSTRUCTION CERTIFICATION:** I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

[x] Driller [ ] Engineer [ ] Trainee Name (Print) Brett Phythian

Driller/Engineer/Trainee Signature _____

Driller or trainee License No. 1249

IF TRAINEE, Driller's Licensed No. _____ Driller's Signature _____

Drilling Company Tumwater Drilling & Pump Inc. 509-548-5361

Address 9290 Hwy 2 / P.O.Box 777

City, State, Zip Dryden / Leavenworth, WA 98826

Contractor's Registration No. TUMWADP 011 LZ Date 09-25-2008

ECY 050-1-20 (Rev 3/05)

Ecology is an Equal Opportunity Employer.

Please print, sign and return to the Department of Ecology

Cascade Gardens Well Log #1

# Water Well Report

Original – Ecology, 1st copy – owner, 2nd copy – driller

**Construction/Decommission**

☐ Construction 257663

☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* _____

**Current**
**Notice of Intent No.** W 210579 well #1

**Unique Ecology Well ID Tag No.** ALF 715

**Water Right Permit No.** _____

**Property Owner Name** Grant County PUD

**Well Street Address** 17230 Highway 2, Leavenworth WA 98826

**City** Leavenworth **County** ~~East~~ Wenatchee

**Location** NW 1/4-1/4 SE 1/4 Sec 12 Twn 26N R 16 EWM or WWM (circle one) K

**Lat/Long (s, t, r still REQUIRED)** Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

**Tax Parcel No** Lot 10, Block 8 + Lots 1-7 Block 8, Plat of Cascade Gardens

**PROPOSED USE:** ☐ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☒ Test Well ☐ Other Test

**TYPE OF WORK:** Owner's number of well (if more than one) _____

☒ New well ☐ Reconditioned ☐ Deepened *Method:* ☐ Dug ☐ Bored ☐ Driven ☐ Cable ☒ Rotary ☐ Jetted

**DIMENSIONS:** Diameter of well 12 inches, drilled 120 ft. Depth of completed well 118.5 ft.

**CONSTRUCTION DETAILS**

Casing Installed: ☒ Welded 12 " Diam. from +2 ft. to 94' ft.
☐ Liner installed _____ " Diam. from _____ ft. to _____ ft.
☐ Threaded _____ " Diam. from _____ ft. to _____ ft.

**Perforations:** ☐ Yes ☒ No

Type of perforator used _____

SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.

**Screens:** ☒ Yes ☐ No ☒ K-Pac Location 91'

Manufacturer's Name Johnson

Type 304 Stainless-Hi Flow Model No. 304

Diam. 16" Slot size 120 from 95 ft. to 118.5 ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

**Gravel/Filter packed:** ☐ Yes ☒ No ☐ Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

**Surface Seal:** ☒ Yes ☐ No To what depth? 18' ft.

Material used in seal Bentonite

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? _____ Depth of strata _____

Method of sealing strata off _____

**PUMP:** Manufacturer's Name _____

Type: _____ H.P. _____

**WATER LEVELS:** Land-surface elevation above mean sea level _____ ft.

Static level 34' ft. below top of well Date Dec 2, 06

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

**WELL TESTS:** Drawdown is amount water level is lowered below static level

Was a pump test made? ☒ Yes ☐ No If yes, by whom? Dave Smith

Yield: 30 gal./min. with not tested by Driller ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

*Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)*

| Time | Water Level | Time | Water Level | Time | Water Level |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

Date of test 12-02-06

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest _____ gal./min. with stem set at _____ ft. for _____ hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water 57° Was a chemical analysis made? ☐ Yes ☒ No

**CONSTRUCTION OR DECOMMISSION PROCEDURE**

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information indicate all water encountered. (USE ADDITIONAL SHEETS IF NECESSARY.)

| MATERIAL | FROM | TO |
|---|---|---|
| Silt | 0 | 5 |
| Sand Gravel | 5 | 21 |
| Sand | 21 | 48 |
| gravel | 48 | 61 |
| Silty gravel | 61 | 63 |
| Sand gravel | 63 | 85 |
| Silty Gravel sand | 85 | 99 |
| Sand Gravel | 99 | 120 |

RECEIVED DEPT. OF ECOLOGY FISCAL & BUDGET DEC 14 2006 DEPARTMENT OF ECOLOGY WELL DRILLING UNIT

RECEIVED DEC 14 2006

RECEIVED DEC 10 2006 DEPARTMENT OF ECOLOGY EASTERN REGIONAL OFFICE

DEPT OF ECOLOGY Received DEC 22 2006 CENTRAL REGION OFFICE

Start Date 9-28-06 Completed Date 12-02-06

**WELL CONSTRUCTION CERTIFICATION:** I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Driller/Engineer/Trainee Name (Print) Dave Smith

Driller/Engineer/Trainee Signature Doris Schnabel

Driller or trainee License No. 2819

**IF TRAINEE,**
Driller's Licensed No. Dave Smith
Driller's Signature 2844T

Drilling Company Bluestar Enterprises North West

Address 2019 Butler Loop

City, State, Zip Richland WA. 99354

Contractor's Registration No. Bluesne 965 KG Date 12-07-06

Ecology is an Equal Opportunity Employer. ECY 050-1-20 (Rev 2/03)

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

Please print, sign and return to the Department of Ecology

Cascade Gardens Well Log #2

# Water Well Report

Original – Ecology, 1st copy – owner, 2nd copy – driller

**Construction/Decommission**

☐ Construction 257664

☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* _____

Current Notice of Intent No. W 210580 well #2

Unique Ecology Well ID Tag No. ALF 714

Water Right Permit No. _____

Property Owner Name Grant County PUD

Well Street Address 12230 Highway 2, Leavenworth WA 98826

City Leavenworth County ~~Chelan~~ 04-Cholan K

Location NW 1/4-1/4 SE 1/4 Sec 12 Twn 26N R 16 EWM or WWM ☒ circle ☐ one

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Lat Min/Sec _____

Long Deg _____ Long Min/Sec _____

Tax Parcel No Lot 10, Blocks 1 of 1-7 Block E Plat of Cascade Gardens

**PROPOSED USE:** ☐ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☒ Test Well ☐ Other _____

**TYPE OF WORK:** Owner's number of well (if more than one) _____

☐ New well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven ☐ Deepened ☐ Cable ☒ Rotary ☐ Jetted

**DIMENSIONS:** Diameter of well 12 inches, drilled 120 ft. Depth of completed well 120 ft.

**CONSTRUCTION DETAILS**

Casing Installed: ☒ Welded 12 " Diam. from +2 ft. to 120 ft.

☐ Liner installed _____ " Diam. from _____ ft. to _____ ft.

☐ Threaded _____ " Diam. from _____ ft. to _____ ft.

**Perforations:** ☐ Yes ☒ No

Type of perforator used _____

SIZE of perfs _____ in. by ___ in. and no. of perfs ____ from ____ ft. to ____ ft.

**Screens:** ☐ Yes ☒ No ☐ K-Pac Location _____

Manufacturer's Name _____

Type _____ Model No. _____

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

**Gravel/Filter packed:** ☐ Yes ☒ No ☐ Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

**Surface Seal:** ☒ Yes ☐ No To what depth? 18 ft.

Material used in seal Bentonite

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? _____ Depth of strata _____

Method of sealing strata off _____

**PUMP:** Manufacturer's Name _____

Type: _____ H.P. _____

**WATER LEVELS:** Land-surface elevation above mean sea level _____ ft.

Static level 20.2 ft. below top of well Date 10-9-06

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

**WELL TESTS:** Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☒ No If yes, by whom? _____

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

*Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)*

| Time | Water Level | Time | Water Level | Time | Water Level |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

Date of test _____

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest 100± gal./min. with stem set at 100 ft. for 2 hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water 57° Was a chemical analysis made? ☐ Yes ☒ No

**CONSTRUCTION OR DECOMMISSION PROCEDURE**

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information indicate all water encountered. (USE ADDITIONAL SHEETS IF NECESSARY.)

| MATERIAL | FROM | TO |
|---|---|---|
| S:lt | 0 | 5 |
| Large Gravel | 6 | 45 |
| Silty Gravel | 45 | 47 |
| Sandy Gravel large | 47 | 78 |
| Small Gravel | 78 | 98 |
| Heavy Sand | 98 | 120 |
| | | |
| | | |
| | | |
| Well Tag 85' | | |
| Bottom Sand | | |

RECEIVED DEC 14 2006 DEPARTMENT OF ECOLOGY WELL DRILLING UNIT

RECEIVED DEC 18 2006 DEPARTMENT OF ECOLOGY EASTERN REGIONAL OFFICE

DEPT OF ECOLOGY Received DEC 22 2006 CENTRAL REGION OFFICE

Start Date 10-07-06 Completed Date 10-09-06

**WELL CONSTRUCTION CERTIFICATION:** I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

Driller/Engineer/Trainee Name (Print) Dave Schuster

Driller/Engineer/Trainee Signature _____

Driller or trainee License No. 2819

**If TRAINEE,**

Driller's Licensed No. Dave Smith

Driller's Signature 2844T

Drilling Company Blue Star Enterprises NorthWest

Address 2019 Butte Loop

City, State, Zip Richland WA 99354

Contractor's Registration No. Bluesse 965KC Date 12-02-06

Ecology is an Equal Opportunity Employer. ECY 050-1-20 (Rev 2/03)

NASON CREEK WELL LOGS
SECTION 2, TOWNSHIP 26 NORTH, RANGE 16 EAST
UNVERIFIED BY PARCEL OR ADDRESS

AVAILABLE UPON REQUEST

NASON CREEK WELL LOGS
SECTION 3, TOWNSHIP 26 NORTH, RANGE 16 EAST
VERIFIED BY PARCEL OR ADDRESS

---

Available Upon Request

NASON CREEK WELL LOGS
SECTION 4, TOWNSHIP 26 NORTH, RANGE 16 EAST
VERIFIED BY PARCEL OR ADDRESS

Available Upon Request

NASON CREEK WELL LOGS
SECTION 7, TOWNSHIP 26 NORTH, RANGE 17 EAST
UNVERIFIED BY PARCEL OR ADDRESS

Available Upon Request

NASON CREEK WELL LOGS
SECTION 8, TOWNSHIP 26 NORTH, RANGE 17 EAST
VERIFIED BY PARCEL OR ADDRESS

Available Upon Request

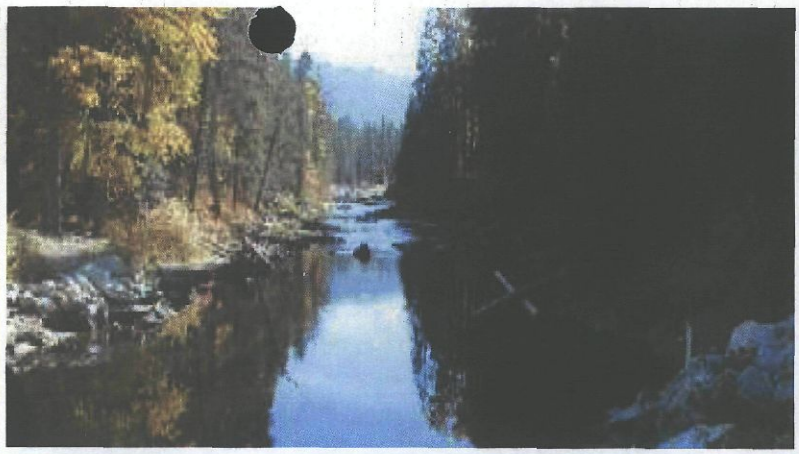
NASON CREEK WELL LOGS
SECTION 11, TOWNSHIP 26 NORTH, RANGE 16 EAST
VERIFIED BY PARCEL OR ADDRESS

Available upon Request

NASON CREEK WELL LOGS
SECTION 12, TOWNSHIP 26 NORTH, RANGE 16 EAST
VERIFIED BY PARCEL OR ADDRESS

Available upon Request

# APPENDIX B
# GEOPHYSICAL INVESTIGATION



Final Report

# Results of the Geophysical Investigation at Nason Creek

Prepared for:
Anchor Environmental, LLC

August 2007



Golder Associates

**Golder Associates Inc.**

18300 NE Union Hill Road, Suite 200
Redmond, WA USA 98052-3333
Telephone (425) 883-0777
Fax (425) 882-5498
www.golder.com

August 24, 2007

Our ref: 073-93255

Anchor Environmental, LLC
PO Box 2517
811 Kirkland Ave., Suite 200
Kirkland, WA 98083-2517

Attention: Mr. Robert Montgomery

**RE: RESULTS OF THE GEOPHYSICAL INVESTIGATION TO SUPPORT HYDROGEOLOGICAL STUDIES OF THE NASON CREEK AREA**

Dear Mr. Montgomery:

This letter report summarizes the results of the terrestrial geophysical investigation conducted at two sites adjacent to Nason Creek (Figure 1). The geophysical survey was conducted to assist in determining the sites potential suitability for providing groundwater for a proposed fish hatchery.

## DESCRIPTION OF THE SITE

The shallow geology consists of terraced deposits along Nason Creek and mass wasting deposits originating from the valley slopes. These deposits are primarily silty and sandy gravels.

The geophysical program was designed to collect subsurface information at the two sites. Seismic reflection Line 1 is located at 17230 Hwy 2 and is referred to as the Cascade Gardens Site. Seismic Reflection Line 2 is located approximately 0.6 miles west and 250 feet south of Hwy 2 at on the Leslie Boyce Property (Figure 1).

## DESCRIPTION OF THE GEOPHYSICAL METHOD

Seismic reflection is the traditional method for mapping the stratigraphy of unconsolidated sediments. This method uses a controlled energy source (hammer, blank shotgun shells, and chemical explosives) to inject a seismic signal into the subsurface. The seismic signal is reflected from interfaces between materials having differing acoustic characteristics such as the interface between sand and gravel. The reflected seismic signals are received by a series of geophones that are connected to a seismic cable laid on the ground in a linear manner. The geophones are placed several inches into the ground and spaced approximately 5 to15 feet apart along the geophone cable.

The seismic energy source is discharged between each of the geophones and every 10 feet off the ends of the line for a distance of approximately 50 feet. The geophones convert the reflected acoustic energy to an electrical signal which is stored on the seismograph for later processing and analysis. The seismic data is processed to determine the seismic velocity of the earth material through which the energy has traveled and to model the subsurface geology. The interpreted geophysical model

depicts the earth in cross-section showing contacts between various stratigraphic units and the thickness of the units. Interpretation of the lithology is based on the seismic characteristics of the reflectors and information obtained from boreholes or test pits.

## GEOPHYSICAL FIELD PROCEDURE

Seismic reflection lines were collected at two locations adjacent to Nason Creek. These locations are shown in Figure 1. Line 1 was oriented approximately parallel to Nason Creek at the Cascade Gardens property. Line 2 was oriented perpendicular to Nason Creek on the Leslie Boyce Property. Each seismic reflection section was 720 feet long.

### Seismic Reflection Procedures

Seismic reflection data were acquired with a Geometric Geode seismic system. This system consisted of three active 24 channel seismographs, linked via an Ethernet cable. Each individual seismograph controlled 24 geophones spaced 10 feet apart. Shot points were recorded every 10 feet beginning 45 feet off the end of the line and continuing through the line and ending 45 feet past the last geophone. This resulted in 83 shot points for each profile. Each shot point consisted of multiple impacts with a 16 lb sledgehammer summed together to produce one record.

## RESULTS OF THE GEOPHYSICAL INVESTIGATION

***Line 1***: Two wells, (W1, W2) one located on either end of the reflection line, were used to assist in interpreting the seismic reflection data (Figure 1).

There are several discontinuous, minor reflectors and two relatively continuous, coherent reflectors observed in the data (Figure 2). On the south end of the line a thin unit of sand and gravel is interpreted over a relatively thick sand unit that extends along the entire length of the section. On the south end, the sand is underlain by approximately 50 feet of sand and gravel, which transitions laterally to silty, sandy gravel on the north half of the line based on the well log of Well 2. Beneath the silty, sandy gravel the well log reports the presence of "heavy" sand. This unit was not fully penetrated in Well 2 but it may be as much as 150 feet thick, based on the seismic reflection data.

The nature of the deeper geologic unit is unknown but, based on it acoustic characteristic, it may consist of unconsolidated sand and gravel.

***Line 2***: The well log from W-11-6, located to the west of the line, and across Nason Creek, was used to assist in interpreting the seismic reflection data. However, the well is located approximately 30 feet lower in elevation than the seismic reflection line. The top of the well is located in or close to the active channel of Nason Creek as indicated by the presence of cobbles and boulders.

There are four relatively continuous, coherent reflectors observed in the Line 2 data (Figure 2). The upper layer is interpreted as silt and clay, based on the acoustic characteristic of the reflection data and the fact that the line was located in a wetland. The base of this unit is between 120 feet and 135 feet below the ground surface. Below the silt and clay are three intermediate layers, interpreted as representing interbedded silt, sand and gravel deposits.

The lowest reflector, at a depth of 250 feet to 280 feet below ground surface, is interpreted as the top of bedrock. However, this interpretation can not be confirmed since the nearest well did not extend to this depth.

A fault appears to offset the interpreted reflectors and the top of bedrock on the east end of the line. This offset corresponds with a major fault that is shown on structural maps of the area. The shallow nature of this offset suggests that this fault is relatively recent.

## RECOMMENDATIONS

Based on the interpretation of the seismic reflection data we suggest that an exploration well be drilled on Line 2 to assess the water supply potential at the Leslie Boyce property. On this line the interpreted seismic reflection data suggests the presence of coarse-grained sediments between 150 feet and 250 feet below ground surface. However, the seismic data also suggests a relatively thick layer of silt, which may affect infiltration of water to the deeper gravels.

At the Cascade Garden property, deepening of Well 2 is likely to encounter up to 100 feet of additional unconsolidated material, reported as heavy sand on the well log. We recommend deepening Well 2 after confirming the supply potential at the Boyce property.

## LIMITATIONS OF GEOPHYSICAL METHODS

Golder services will be conducted in a manner consistent with that level of care and skill ordinarily exercised by other members of the geophysical community currently practicing under similar conditions subject to the time limits, and financial and physical constraints applicable to the services. Seismic reflection is remote sensing geophysical methods that may not detect all subsurface features of concern. Furthermore, subsurface horizons or reflectors identified as the contact between unconsolidated sedimentary units or the top of bedrock may be found to have been misinterpreted based on boreholes or other intrusive sampling methods.

## CLOSURE

We appreciate the opportunity to work with you with on this project. If you have any further questions please call either Dick or myself at (425) 883-0777.

Sincerely,

**GOLDER ASSOCIATES INC.**

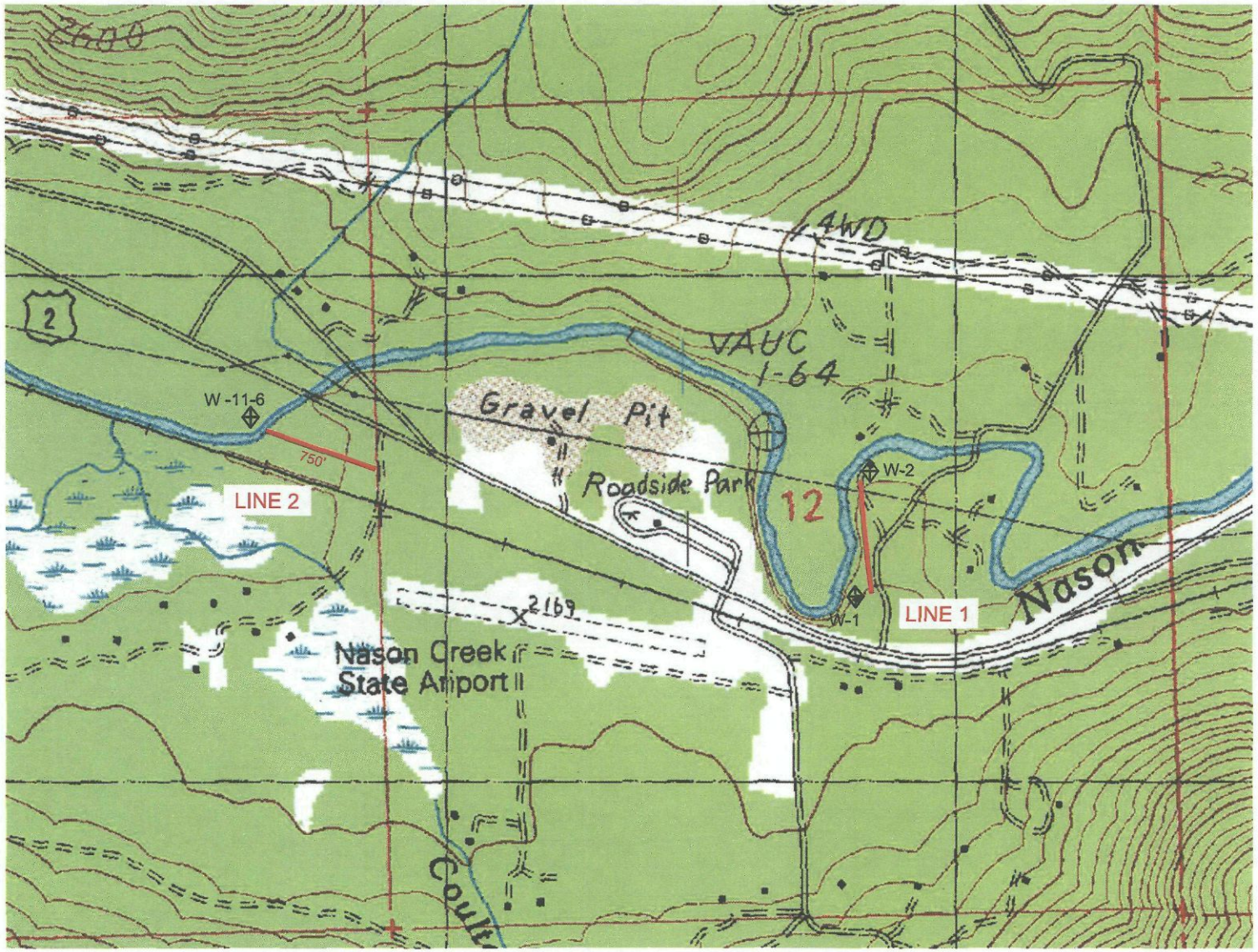
Matthew A. Benson
Senior Geophysicist

Richard E. Sylwester L.G. L.E.G
Associate, Senior Geophysicist

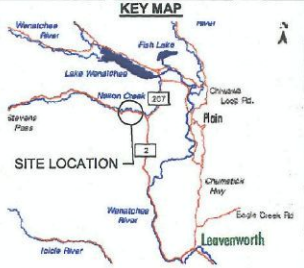
Attachments: Figures 1 and 2

MAB/RES/tp

# FIGURES




**KEY MAP**




**LEGEND**

- SEISMIC REFLECTION LINE
- WELLS
- SITE 1 — CASCADE GARDENS PROPERTY
- SITE 2 — LESLIE BOYCE PROPERTY

N

0 500 1000

APPROX. SCALE IN FEET

**NOTES**

- DATA COLLECTED 7/23/07 AND 7/24/07
- PROCESSED WITH SEISMIC PROCESSING WORKSHOP

**INSTRUMENTATION**

- Geod 96-channel Seismis System

**GEODETIC PARAMETERS**

VERT. DATUM: - LOCAL GRID
HORIZ. DATUM:
PROJECTION:

Golder Associates

GOLDER ASSOCIATES INC.
18300 NE UNION HILL ROAD, STE. 200
REDMOND, WA USA 98052-3333
TEL: (425) 883-0777
FAX: (425) 882-5498

SUBMITTED TO:

ANCHOR
ANCHOR ENVIORNMENTAL, LLC

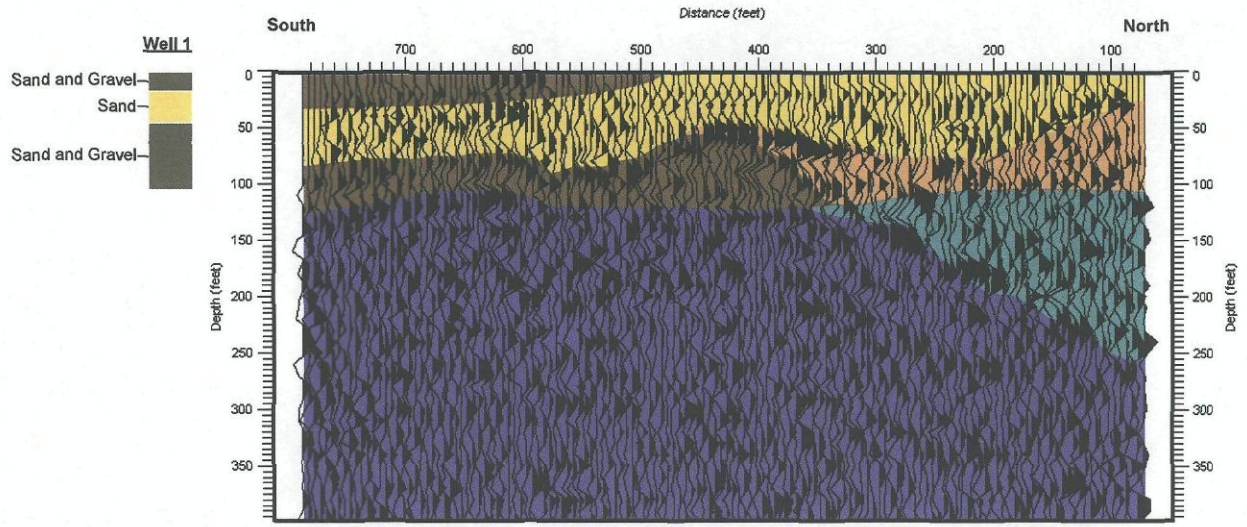
PROJECT:
ANCHOR ENVIORNAMENTAL/ NASON CREEK GEOPHYSICS/WA

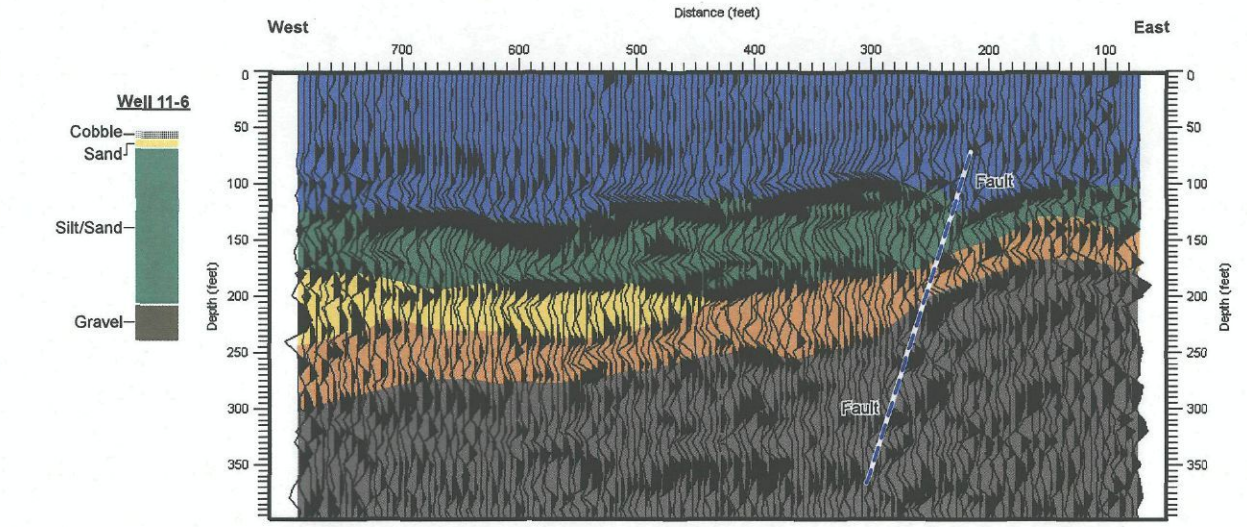
TITLE:

**NASON CREEK SEISMIC REFLECTION SURVEY**

| | | | | |
|---|---|---|---|---|
| PROJECT | 073-93460 | DESIGN | MB | 08-20-07 |
| FILE No. | 073_93460_000_F01 | CADD | ACF | 08-20-07 |
| REV. | 0 | CHECK | MB | 08-20-07 |
| SCALE | AS SHOWN | REVIEW | DS | 08-20-07 |

**FIGURE 1**




**KEY MAP**


**LEGEND**

- Silt/Clay
- Silty Sand
- Sand
- Sand/Gravel
- Heavy Sand
- silty, sandy, GRAVEL
- Unknown
- Bedrock

See Figure 1 for Location of Wells

**INSTRUMENTATION**

Geometric Geode Seismograph
Hammer Energy Source

**GEODETIC PARAMETERS**

VERT. DATUM: Ref to Ground Surface
HORIZ. DATUM: Local Grid


Golder Associates
GOLDER ASSOCIATES INC.
18300 NE UNION HILL ROAD, STE. 200
REDMOND, WA USA 98052-3333
TEL: (425) 883-0777
FAX: (425) 882-5498


SUBMITTED TO:
ANCHOR
ANCHOR ENVIRONMENTAL, LLC

PROJECT:
ANCHOR ENVIRONMENTAL/NASON CREEK GEOPHYSICS/WA

TITLE:
**INTERPRETED SEISMIC REFLECTION PROFILE**

| | | | | |
|---|---|---|---|---|
| PROJECT | 073-93263.000 | DESIGN | XXX | - |
| FILE No. | 07393263000fig02.ai | DRAFT | AMP | 08/22/07 |
| REV. | 0 | CHECK | XXX | - |
| SCALE | AS SHOWN | REVIEW | XXX | - |

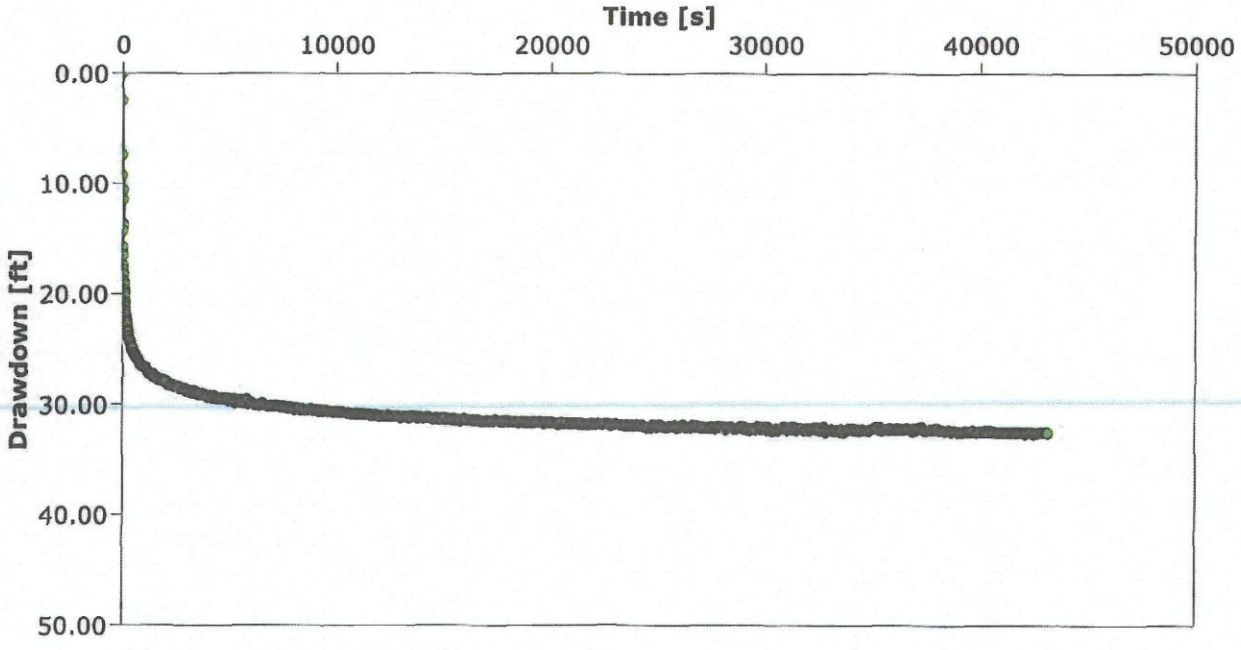
**FIGURE 2**

07393263000fig02.ai

# APPENDIX C
# AQUIFER PUMP TEST RESULTS

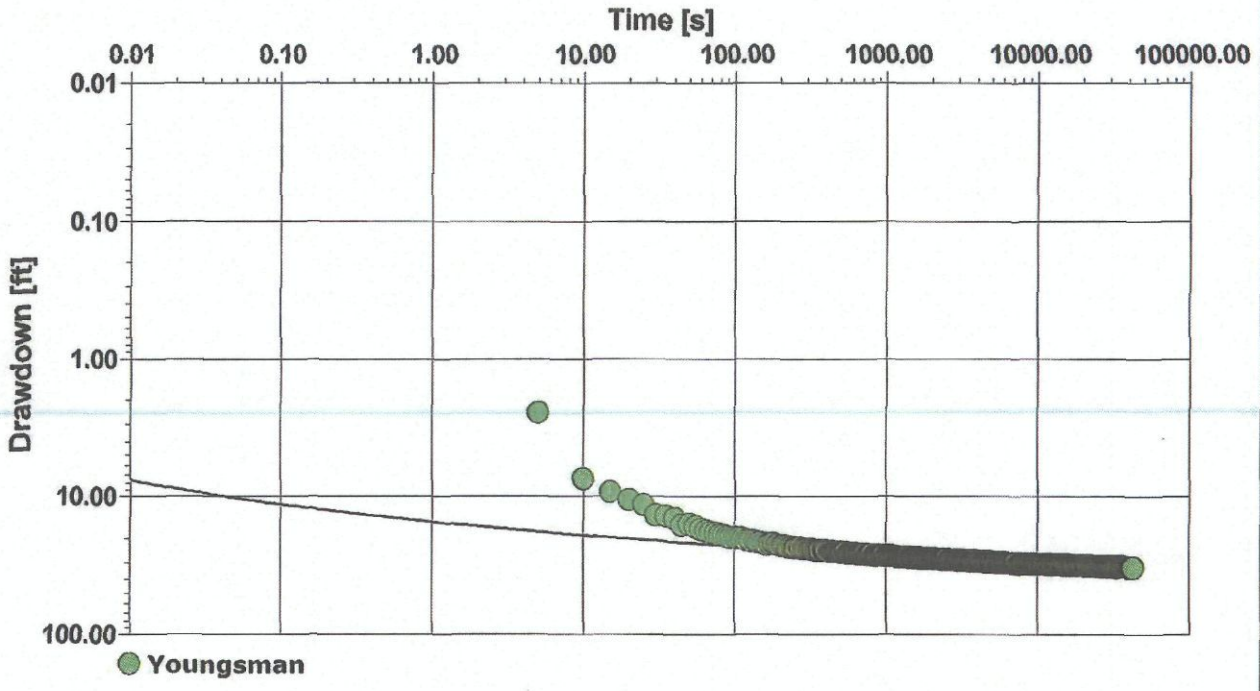
| City, State/Province<br>Address<br>Contact Info<br>Company Name | Pumping Test Analysis Report |
|---|---|
| | Project: White River and Nason Creek Wells |
| | Number: 060391-01 |
| | Client: Grant Co. PUD |

| | | |
|---|---|---|
| Location: Chelan Co., Washington | Pumping Test: Youngsman Pump Test | Pumping well: Youngsman |
| Test conducted by: Craig Wells | | Test date: 10/1/2008 |
| Analysis performed by: Matt Wilson | Time vs Drawdown | Date: 10/17/2008 |
| Aquifer Thickness: 29.00 ft | Discharge rate: 206 [U.S. gal/min] | |



| City, State/Province<br>Address<br>Contact Info<br>Company Name | Pumping Test Analysis Report |
|---|---|
| | Project: White River and Nason Creek Wells |
| | Number: 060391-01 |
| | Client: Grant Co. PUD |

| | | |
|---|---|---|
| Location: Chelan Co., Washington | Pumping Test: Youngsman Pump Test | Pumping well: Youngsman |
| Test conducted by: Craig Wells | | Test date: 10/1/2008 |
| Analysis performed by: Matt Wilson | Theis | Date: 10/20/2008 |
| Aquifer Thickness: 29.00 ft | Discharge rate: 206 [U.S. gal/min] | |

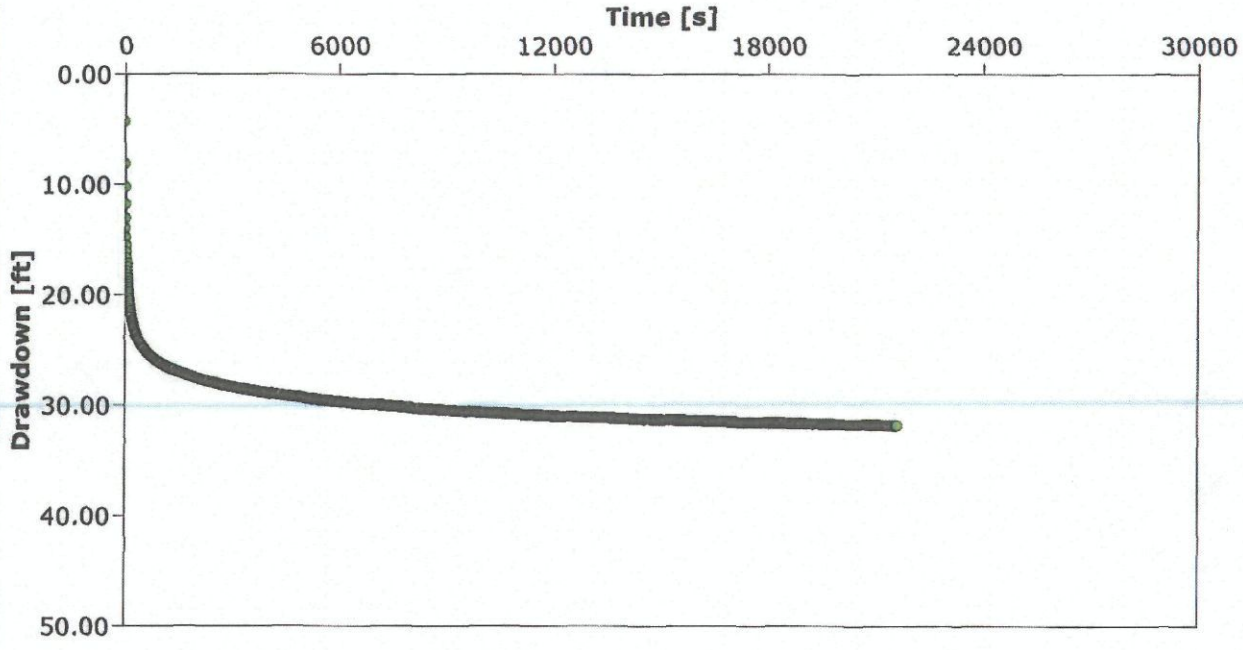



Calculation after Theis

| Observation well | Transmissivity [ft²/d] | K [ft/d] | Storage coefficient | Radial distance to PW [ft] | |
|---|---|---|---|---|---|
| Youngsman | $1.91 \times 10^{3}$ | $6.59 \times 10^{1}$ | $1.14 \times 10^{-4}$ | 0.21 | |

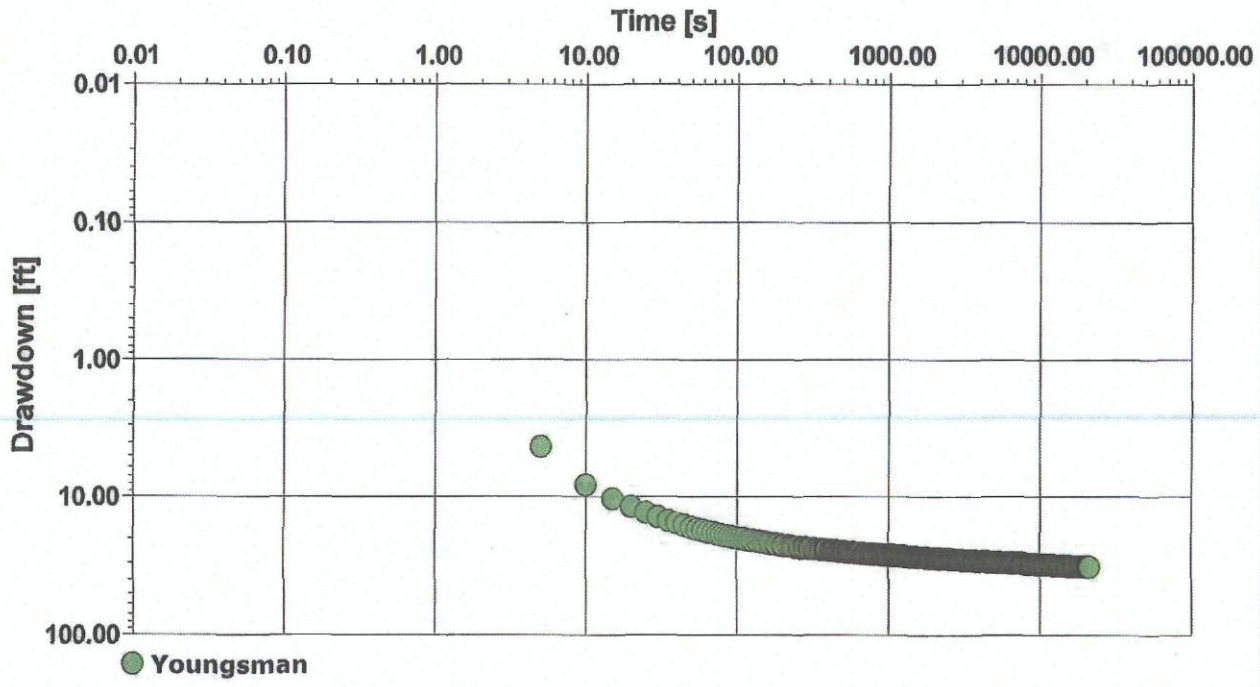
| City, State/Province<br>Address<br>Contact Info<br>Company Name | Pumping Test Analysis Report |
|---|---|
| | Project: White River and Nason Creek Wells |
| | Number: 060391-01 |
| | Client: Grant Co. PUD |

| | | |
|---|---|---|
| Location: Chelan Co., Washington | Pumping Test: Youngsman Pump Test | Pumping well: Youngsman |
| Test conducted by: Craig Wells | | Test date: 10/1/2008 |
| Analysis performed by: Matt Wilson | Time vs Drawdown | Date: 10/17/2008 |
| Aquifer Thickness: 29.00 ft | Discharge: variable, average rate 102.86 [U.S. gal/min] | |



| City, State/Province<br>Address<br>Contact Info<br>Company Name | Pumping Test Analysis Report |
|---|---|
| | Project: White River and Nason Creek Wells |
| | Number: 060391-01 |
| | Client: Grant Co. PUD |

| | | |
|---|---|---|
| Location: Chelan Co., Washington | Pumping Test: Youngsman Pump Test | Pumping well: Youngsman |
| Test conducted by: Craig Wells | | Test date: 10/1/2008 |
| Analysis performed by: Matt Wilson | Recovery | Date: 10/17/2008 |
| Aquifer Thickness: 29.00 ft | Discharge: variable, average rate 102.86 [U.S. gal/min] | |




Calculation after AGARWAL + Theis

| Observation well | Transmissivity [ft²/d] | K [ft/d] | Storage coefficient | Radial distance to PW [ft] | |
|---|---|---|---|---|---|
| Youngsman | $1.58 \times 10^{2}$ | $5.44 \times 10^{0}$ | $2.05 \times 10^{-15}$ | 0.21 | |

Grant County
PUBLIC UTILITY DISTRICT
Excellence in Service and Leadership



fee exempt awaiting cost-Reimb. agreement.
EG 5/20/2010
2 apps: 1) 9184 gpm
1) 800 gpm

May 12, 2010

Melissa M. Downes
Washington Department of Ecology–Central Regional Office
15 West Yakima Ave -- Suite 200
Yakima, WA 98902-3452

**RE: Water Right Permit Applications – Nason Creek spring Chinook salmon hatchery project**

Dear Ms. Downes,

Enclosed are Water Right Permit Applications for surface and ground water for a proposed Nason Creek spring Chinook hatchery project adjacent to Nason Creek in Chelan County. This project is being proposed by Public Utility District No. 2 of Grant County (Grant PUD) in accordance with a 2008 Biological Opinion issued by the National Marine Fisheries Service, which was incorporated into Grant PUD's federal operating license for the Priest Rapids Hydroelectric Project on the Columbia River. The Biological Opinion requires Grant PUD to develop and implement an artificial propagation program for Nason Creek spring Chinook salmon. The objective of the program is to increase the number of natural origin Nason Creek spring Chinook salmon that spawn in the natural environment. The water rights requested in these applications will allow construction and operation of adult holding, rearing, and acclimation vessels along with egg incubation buildings to help propagate Nason Creek spring Chinook.

Grant PUD is requesting these applications receive priority processing consideration as they meet the criteria under WAC 173-152-050, Section (2) (A)"*The proposed water use is non-consumptive and if approved would substantially enhance or protect the quality of the natural environment.*"Grant PUD also requests that in order to provide expedited review of these applications, they be processed through cost-reimbursement, per RCW 90.03.265. Grant PUD understands that because these applications also qualify for priority processing, it will only need to reimburse Ecology for the cost of processing Grant PUD's applications. (Universe of 1 - don't have to pay for any other aps - just themselves)

As an appendix to this letter, additional information has been included that provides details on the proposed location of the hatchery facility, anticipated water needs, existing data (e.g. streamflow and hydrogeologic data), and other information that will be needed

to successfully process these applications. Some of this information has already been obtained (e.g. streamflow data), while other evaluations need to be completed and will be provided to Ecology upon their completion (e.g. finalization of groundwater evaluations).

Please direct questions to Ross Hendrick, at the address below, email at rhendr1@gcpud.org, or phone at 509-754-5088, ext. 2468.

Thank you for your consideration.

Sincerely

Tom Dresser
Fish, Wildlife, and Water Quality Manger

cc: Todd Pearsons, GCPUD
Joe Lukas, GCPUD
Ross Hendrick, GCPUD
Julie Pyper, GCPUD
PRCC–Hatchery Subcommittee
Mark Schuppe, WDOE

## GRANT PUD WATER RIGHT APPLICATIONS
## -SUPPLEMENTAL INFORMATION-

**Proposed Location**

The proposed Nason Creek Hatchery Facility sits southwest of Leavenworth at approximately river mile (RM) nine of Nason Creek (Figures 1 and 2). The facility will use two parcels located along US Highway 2 approximately 17 miles west of Leavenworth, WA. The first parcel (Boyce) is approximately 3.75 acres, is listed as tax parcel 261611140020, and is adjacent to Nason Creek; the second parcel (Youngsman) is approximately 5 acres, is listed as tax parcel 261612230100, and is adjacent to and east of the Boyce parcel. Together these two parcels are referred to as the Boyce/Youngsman site (see Figures 1 and 2 and Attachment C to the applications). The proposed river water intake is located on the outside bend of Nason Creek.

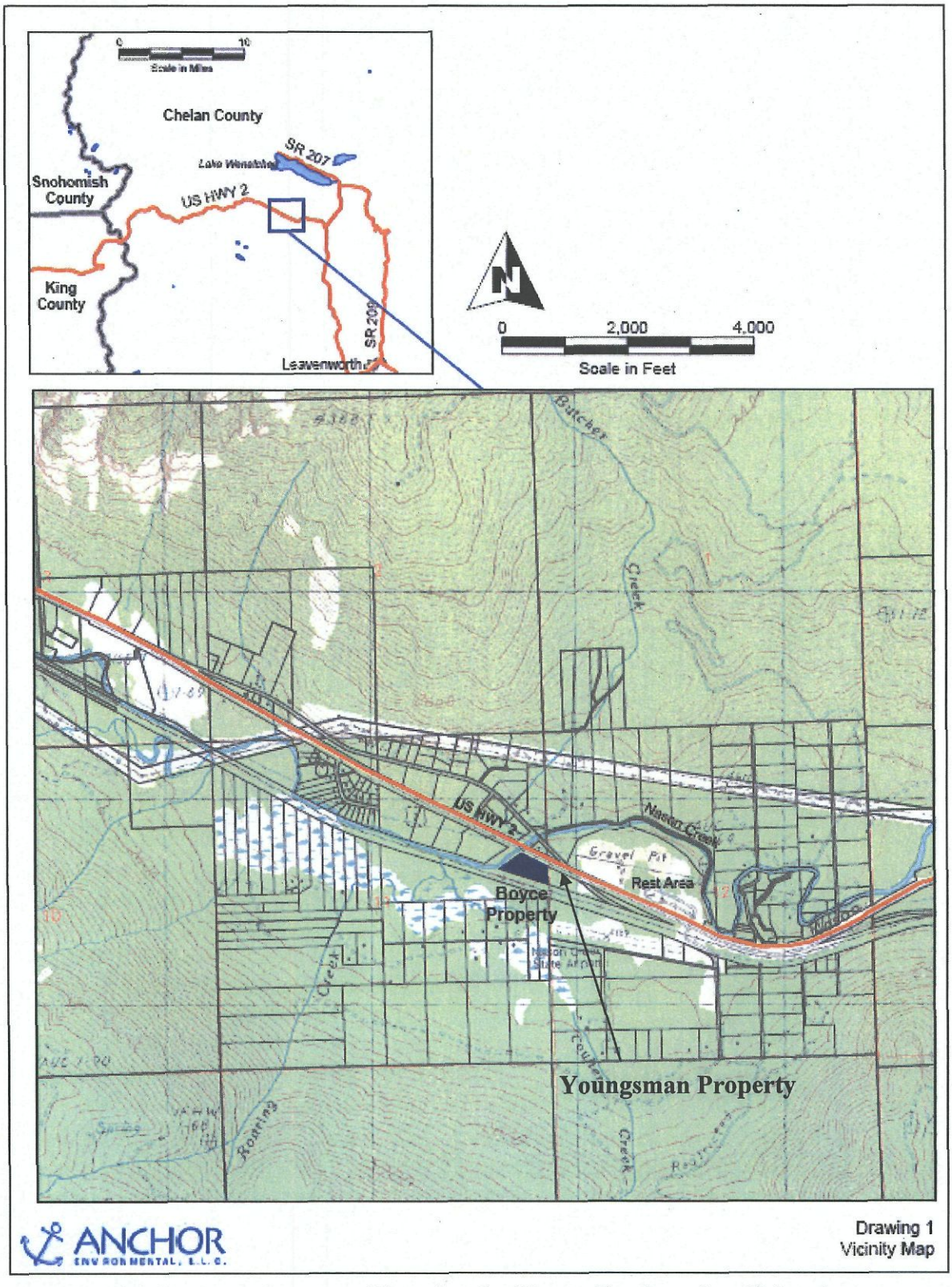



**Figure 1: Vicinity map of proposed location for Nason Creek spring Chinook hatchery facility.**

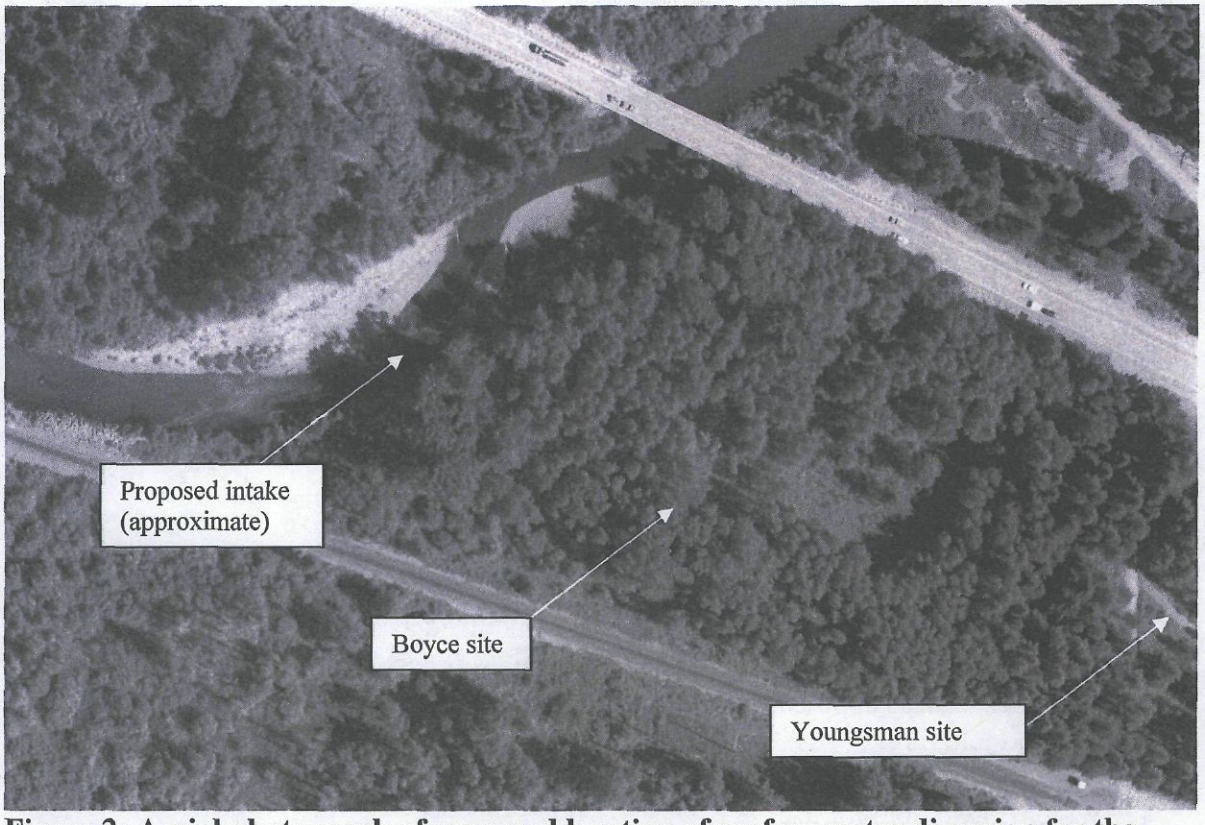



**Figure 2: Aerial photograph of proposed location of surface water diversion for the Nason Creek hatchery facility along right bank of Nason Creek, Chelan County, WA. Flow direction is from left to right.**

## Proposed Water Use

The surface water right requested will be for non-consumptive use of up to 11.5 cfs for fish production. Depending on the time of year, surface water use will be lower (down to 3 cfs). Table 1 presents the anticipated water supply needs for all stages of the hatchery program. Water will be diverted from Nason Creek just southwest of the US Highway 2 bridge crossing. The water will be circulated through the hatchery facility adult holding, rearing, and/or acclimation vessels, settling pond, and discharged immediately downstream (less than 300 ft) of the intake. The groundwater right permit requested will be for non-consumptive use of up to 800 gpm for fish production. Water will also be pumped from wells and sprayed on the surface water intake screens as needed to keep frazil ice from forming during freezing conditions. Both the surface water and groundwater uses will be non-consumptive and used for the production of up to 250,000 spring Chinook smolts (facility will be designed for an additional 10% capacity). Portions of Grant PUD's White River spring Chinook salmon supplementation program will also be produced here (e.g. adult holding and incubation) prior to transfer to separate, off-site facilities.

**Table 1: Water Supply Requirements for Nason Creek spring Chinook hatchery facility.**

| Source | Purpose | Amount (cfs) | Amount (gpm) | Time Period |
|---|---|---|---|---|
| Nason Creek | Fish Holding, Rearing, and Acclimation | 11.5 | 5152 | Nov-May (approximate) |
| Nason Creek | Fish Holding and Rearing | 3 | 1344 | June-July (approximate) |
| Nason Creek | Fish Holding and Rearing | 6 | 2688 | Aug-Oct (approximate) |
| Groundwater | Fish Holding, Egg Incubation, Rearing, and Acclimation | 1.8 | 800 | Continuous |

Additional information, such as more detailed groundwater evaluation results, documentation supporting the environmental benefits of the water use, and/or other information needed to process the application is included as attachments to the application and/or will be added to this application as it becomes available. Grant PUD anticipates that these applications will meet the four-part test required by RCW 90.03.290, including:

1. Water is available for use:

*a. Surface water:*

The surface water intake for the proposed hatchery facility would be upstream and south of the US Highway 2 bridge crossing and adjacent to the Boyce site (see Figure 3 and Attachment C to the applications). The Washington State Department of Ecology (WDOE) operates a flow monitoring station on Nason Creek at RM 0.2 (www.ecy.wa.gov - Station 45J070). This station went into operation in May of 2002. Since then the instantaneous yearly low water discharge reading was 14.5 cfs in August of 2005. Table 2 provides summary information based on flow values provided by the WDOE flow monitoring station for the 2002-2009 time period compared with the estimated peak facility water requirements. Based on this data, peak surface water use for this facility is expected to be less than 11% of any mean monthly flow.

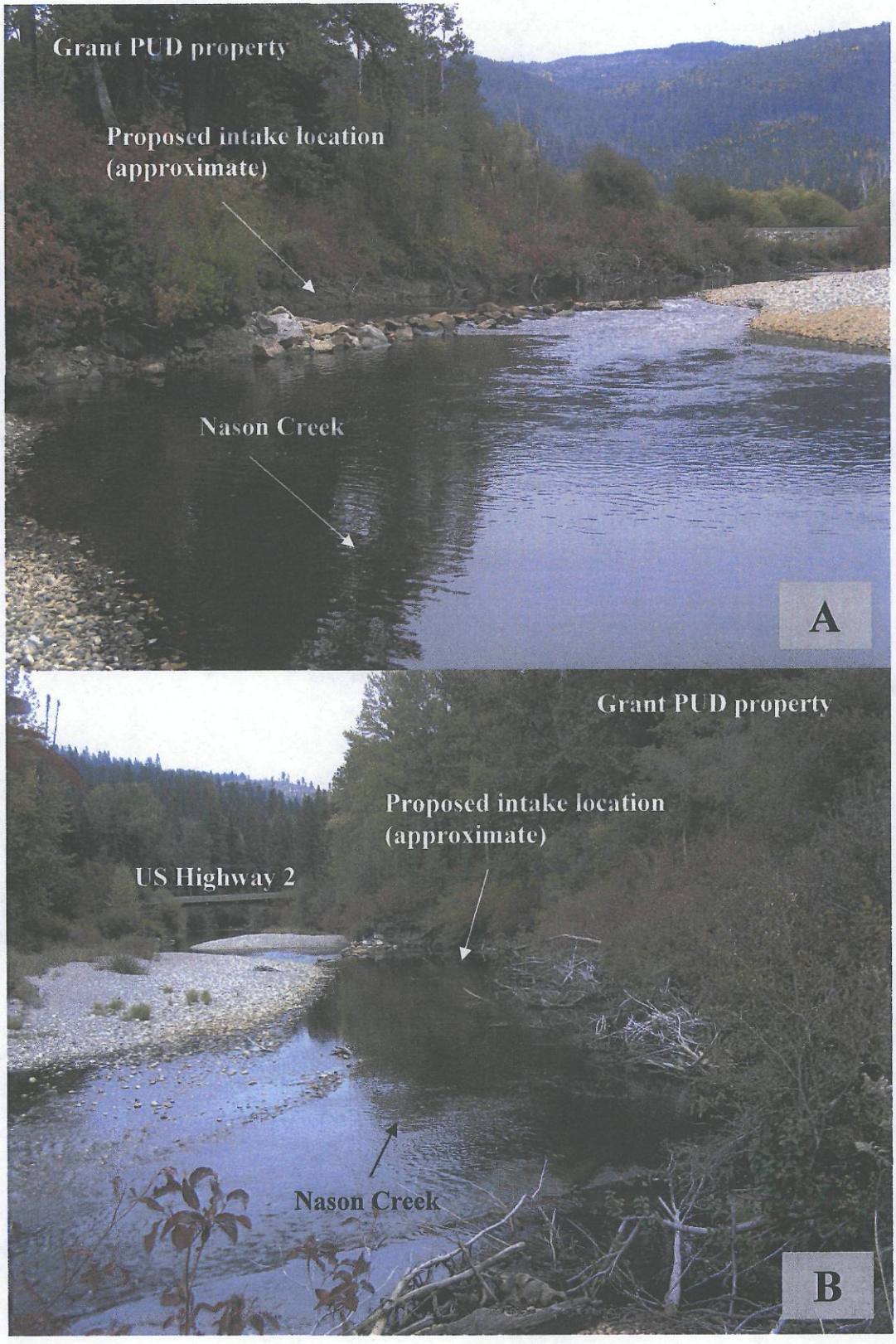



**Figure 3: Photograph of proposed site for surface water intake for hatchery facility adjacent to Nason Creek, looking upstream (A) and downstream (B).**

**Table 2: Estimated water quantity requirements and historical river flows from 2002-2009.**

| | Oct | Nov | Dec | Jan | Feb | Mar |
|---|---|---|---|---|---|---|
| 2008 Mean Daily | 90 | 120 | 266 | 184 | 236 | 138 |
| Max. Daily | 1500 | 2510 | 2400 | 4230 | 1260 | 2180 |
| Min. Daily | 22 | 35. | 58 | 52 | 82 | 98 |
| Instantaneous (Inst.) Min. | 21 | 33 | 57 | 42 | 77 | 84 |
| Mean | 92 | 270 | 262 | 346 | 209 | 293 |
| Groundwater Req. (cfs) | 0.1 | 0.1 | 0.5 | 0.5 | 0.5 | 0.5 |
| Surface Water Req. (cfs) | 6 | 9 | 9 | 10 | 9 | 9 |
| Total Hatchery Req. (cfs) | 6 | 9 | 10 | 10 | 10 | 10 |
| SW Req. % of Mean | 6% | 3% | 3% | 3% | 4% | 3% |
| SW Req. % of Min. | 27% | 24% | 16% | 18% | 12% | 10% |
| SW Req. % of Inst. Min | 29% | 26% | 17% | 24% | 13% | 12% |

| | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|
| 2008 Mean Daily | 198 | 729 | 1120 | 457 | 89 | 50 |
| Max. Daily | 1550 | 5820 | 3550 | 2070 | 168 | 325 |
| Min. Daily | 110 | 252 | 97.5 | 43.9 | 16.5 | 16.5 |
| Instantaneous (Inst.) Min. | 109 | 241 | 94.8 | 42.4 | 14.7 | 15.7 |
| Mean | 428 | 1048 | 972 | 232 | 60 | 48 |
| Groundwater Req. (cfs) | 1 | 1 | 0 | 1 | 1 | 1 |
| Surface Water Req. (cfs) | 10 | 12 | 3 | 2 | 4 | 5 |
| Total Hatchery Req. (cfs) | 11 | 13 | 3 | 3 | 5 | 6 |
| SW Req. % of Mean | 2% | 1% | 0% | 1% | 7% | 11% |
| SW Req. % of Min. | 9% | 5% | 3% | 4% | 26% | 31% |
| SW Req. % of Inst. Min | 10% | 5% | 3% | 7% | 36% | 40% |

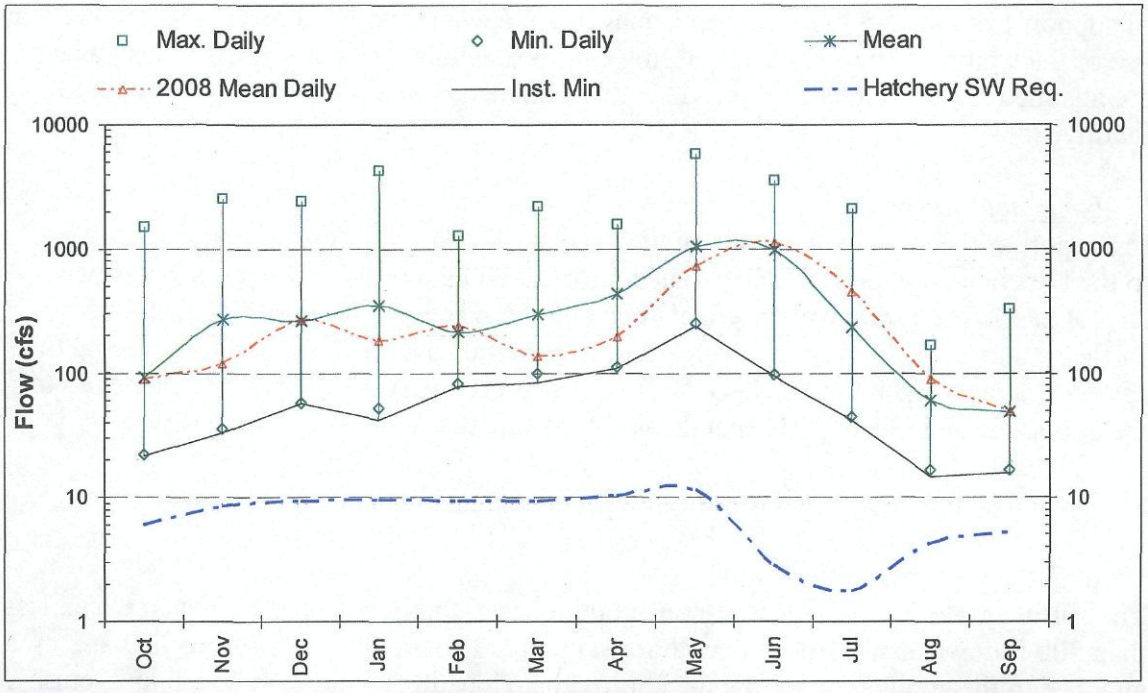



**Figure 4: Summary of historical (2002-2009) flows compared to proposed hatchery surface water flow requirements; data from WDOE flow monitoring station 45J070.**

*b. Groundwater:*

Information on available groundwater will be provided through test well logs, analysis of aquifer properties, and pump test and groundwater modeling results. This information is intended to include enough data to conclude that water will be available for continuous use for up to 1.8 cfs. To date two test wells have been drilled (one on each site) and a pump test was performed on the second well (on the Youngsman site). The first well (on the Boyce site) did not produce adequate water baring formations. The second well was produced 206 gallons per minute (gpm) and based on results of the pump test and subsequent modeling by Anchor QEA, it is estimated the Youngsman site could produce a safe water yield of 600 gpm. See Attachment F to the groundwater applications for the draft groundwater report. A third well is currently scheduled to be drilled in the summer of 2010 to verify the results of the second well pump test and subsequent groundwater modeling results. Although the preliminary estimates indicate a 600 gpm pumping rate, the groundwater application requests 800 gpm in the event that groundwater estimates increase based on results of the third test well; if the estimate remains at 600 gpm, Grant PUD will reduce the amount requested to 600 gpm.

2. Water will be put to beneficial use:

*a. Surface water:*

The surface water will be put to the beneficial use of producing up to 250,000 spring Chinook salmon on an annual basis. This hatchery facility will help meet the requirements of 2008 Biological Opinion issued by NMFS and will help Grant PUD mitigate for its unavoidable impacts to upstream salmonid populations. Grant PUD can provide WDOE with additional detail of its mitigation requirements if requested. Letters

of support from the fishery resource management agencies will also discuss the beneficial use of the water for supplementing spring Chinook salmon. The preliminary designs that are attached to the applications provide additional detail on the layout of the proposed facility.

*b. Groundwater:*

In support of the surface water supply use explained above, the groundwater will be put to the beneficial use helping to produce up to 250,000 spring Chinook salmon on an annual basis. The groundwater will also be put to the beneficial use of keeping the surface water intake screen free of ice during extreme cold conditions, thus allowing the surface water to reach the hatchery facility. The preliminary designs that are attached to the applications provide additional detail on the layout of the proposed facility.

3. Water use will not impair existing rights:

*a. Surface water:*

The surface water use will be non-consumptive, as it will be returned to Nason Creek less than 300 ft downstream from the withdrawal point. The preliminary designs that are attached to the applications show the approximate location of the withdrawal and return points. The bypass reach will not impair existing aquatic habitat. Letters from fishery resource management agencies will be provided to WDOE that support that there would be negligible impacts to aquatic habitat within the bypass reach, and those negligible impacts would be significantly outweighed by the benefits associated with Grant PUD's Nason Creek spring Chinook artificial propagation program and this hatchery facility.

*b. Groundwater:*

As explained in item 1b above, groundwater evaluations and modeling are nearly complete, with only one additional test well needed to verify the initial pump test and aquifer modeling work completed to date. Initial modeling results indicate no negative impact to existing groundwater wells or Nason Creek streamflows (see Attachment F to the groundwater application). Grant PUD will provide WDOE with additional information related to aquifer properties, pumping rates, drawdown, and recovery from the third test well and updated model to be completed in 2010.

4. Water use will not be detrimental to public interest:

*a. Surface water:*

The use of surface water will not be detrimental to public interest because it is non-consumptive and will be returned back to Nason Creek less than 300 ft from the intake location. Water quality testing will occur above the intake and below the outfall to verify that water quality standards are being met and that there are no detectable increases in phosphorus. The proposed hatchery facility that this water use will support will help Grant PUD meet its mitigation requirements of its Priest Rapids Hydroelectric Project, which includes specific requirements to develop a Nason Creek spring Chinook artificial propagation program.

*b. Groundwater:*

The use of groundwater will not be detrimental to public interest because it is non-consumptive and will be returned back to Nason Creek less than 300 ft from the intake location. Results from the groundwater testing and modeling done in 2008 indicate no negative impacts to adjacent groundwater wells or Nason Creek streamflows based on proposed pumping rates (see Attachment F to groundwater application). An additional test well and pump test will be completed in 2010 to verify these results and conclusions. Water quality testing will occur above the intake and below the outfall to verify that water quality standards are being met and that there are no detectable increases in phosphorus. The proposed hatchery facility that this water use will support will help Grant PUD meet its mitigation requirements of its Priest Rapids Hydroelectric Project, which includes specific requirements to develop a Nason Creek spring Chinook artificial propagation program.

**Additional information to be provided**

The following information is included in the application or will be added to the file at a later date:

1. Preliminary facility design layout. Prepared by Jacobs Engineering, Inc (Attachment C of applications).

2. Nason Creek Groundwater Report. Prepared by Anchor QEA. Includes results of the groundwater modeling effort and geophysical investigation (by Golder Associates) (Attachment F of groundwater application).

3. Well log and pump test results from an additional test well. To be performed in summer of 2010.

4. Letters of support from fishery management agencies and tribes.

5. Copies of all environmental permit applications and SEPA/NEPA documentation for the construction and operation of the hatchery facility.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